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CIVIL ENGINEERING.

Extract from the Report on the Texas Western Railroad Company.

In the winter of 1852 the Legislature of the State of Texas incorporated this Company, and invested it with the right to locate, construct, own, and maintain a Railroad from the Eastern boundary of Texas to El Paso, on the Rio Grande—a distance of about 800 miles. With the charter, they also granted a donation of eight sections of land of 640 acres each, for every mile of road actually completed by them ready for use; which grant was increased by the next Legislature, January 30, 1854, to sixteen sections, or 10,240 acres of land for every mile of road so constructed —lands to be made over to the company as soon as twenty-five miles of the road should be completed, and afterwards on the completion of every five miles of road, until the whole road should be finished. The unsold lands, comprising about three-fourths of the whole, along the entire line of the road through Texas, and two degrees, or about 140 miles in width, are exempt from entry, and reserved for the construction of the road; which will enable the company to make very choice and valuable selections; and with the road built up to them, must be worth on the average, including town sites, &c., at least five dollars per acre.

Knowing that the line of this road must evidently be the track of the great Pacific Railroad, the company, at great expense, employed Col. A. B. Gray, late U. S. Commissioner of the Mexican Boundary Commission, with an ample corps of Engineers, to survey this route from Texas to the Pacific. His able and very valuable report is now published, and is commended to the careful consideration of the public. Extracts from

it will be found hereafter. By this survey the whole route is shown to be perfectly easy and practicable, with favorable grades and curves—equal in the average, to those of our Western Railroads; free from inclined planes and tunnels—passing through a country surpassingly rich in soil and minerals—abounding in wood and water, coal, iron, and stone, and a forest growth suitable for all building purposes, far more than three-fourths of the whole distance—south of the snow and mountains, with a most salubrious climate, and with no deserts intervening on this route between the Mississippi River and the Gulf of California, in the proper direction for San Francisco. The cost of the road, and equipment through the State of Texas, (783 miles,) from navigable waters of the Mississippi near Shreeveport, Louisiana, to the Rio Grande, near El Paso, is $19,688,366. Average cost per mile, $25,114.

Total cost of Railway (1621 miles) from navigable waters of the Mississippi—eastern boundary of Texas—to the Harbors of the Pacific, $44,470,674. Value of lands donated under Texas Western Railroad Charter, granted February 16, 1852, (8 sections to the mile, and estimating only 8 under Act of 30th January, 1854), 10,240 acres for every mile of road built, as per estimate in the first Division, $44,789,760.

The estimated net profits, when completed, is shown to exceed those of any other Railroad on this continent.

Major Blanche, the chief engineer of the company, with a corps of able assistants, has made an accurate survey of the first hundred and fifty-five miles of the road, to a point beyond the Trinity, and found it to be most favorable, estimating the average cost, per mile, complete and ready for use, at $22,000, and with no grade exceeding thirty-six feet per mile.

On the 4th of July last, we commenced building the road on this route, at Caddo Lake, an excellent steamboat landing on the navigable waters of Red River. We are still progressing with the work, but not with as large a force as we would have had, could we have enjoyed the usual facilities of navigation on Red River, which have in a great measure been cut off by the extreme and unprecedented drought in the South and West for the last year.

Recently, one hundred additional miles of the road have been let to a company of responsible and efficient Contractors—the work to be commenced by the first of November next (1855); to be prosecuted vigorously, with a large force, until completed.

The first section of fifteen miles, from our steamboat landing, brings us to Marshall, the capital of the rich and populous county of Harrison, in Texas, over which a vast amount of cotton would be transported. It is the estimate of our engineer, that these fifteen miles of road will yield a net profit scarcely exceeded by any road in the United States; and, when extended through the rich and populous counties westward, this rate of profit will be greatly augmented. For several hundred miles from the commencement of our road, the counties of Texas through which it runs, are now more densely populated than the average counties of the Southern States; and affording, even at the present time, sufficient business to render a road profitable. The emigration to these counties is now immense, growing in part out of the location of this road, as also

arising from the wonderful fertility of the soil, and remarkable salubrity of the climate.

It is now universally conceded that this will be the great trunk road, to which all other roads in the South and West will seek to unite—connecting on the eastern line of Texas, with the Vicksburg, Shreeveport, and Texas road, the whole of which, from the boundary of Texas, twenty miles east of Marshall, to Vicksburg, on the Mississippi River, is now under contract. The State of Louisiana takes a deep interest in this road, and has lately subscribed 2,000,000 of dollars for the speedy prosecution and early completion of the work.

By this connexion, we reach the Mississippi River at an early day, and at Vicksburg unite with the whole system of Southern railroads, of some six thousand miles in extent. By these we reach the more northerly roads, bringing us to all the cities of the interior, the Gulf of Mexico, and the sea-board of the Atlantic.

The New Orleans and Opelousas Railroad Company, anxious to connect with us as soon as practicable, are now extending their road through Louisiana and Eastern Texas to Marshall. This road will be about 326 miles in length, 120 of which is now in operation, and 47 miles more nearly ready for the superstructure; by which branch we have direct and easy communication from the city of New Orleans. The Galveston, Houston, and Henderson Railroad will also intersect our road at Marshall, about fifty miles of it being now in operation, and the means provided for the completion of the balance—about 400 miles. Other roads, extending in a northerly direction from the Gulf in Texas, will form connexion with us at different points along the line, as will best suit their interests. The Memphis and Little Rock Railroad and the Cairo and Fulton Railroad, will connect with us at Marshall. The former of these is now under contract for the entire length, and the latter, it is understood, will be put under contract the whole distance (310 miles) to Fulton early next season. Both of these roads have grants of six sections of land for every mile of road. When the latter road is completed, Marshall, in Texas, will be brought within 750 miles, or 30 hours of Cincinnati, and within 550 miles, or 22 hours, of St. Louis; thus saving in time 14 or 15 days, and in distance 1200 to 1400 miles. Marshall will become a great commercial centre—a depot for an immense trade. In extending our branch to Fulton, we cross Caddo Lake, which connects us with the navigable waters of Red River, and opens a water communication with the whole valley of the Mississippi.

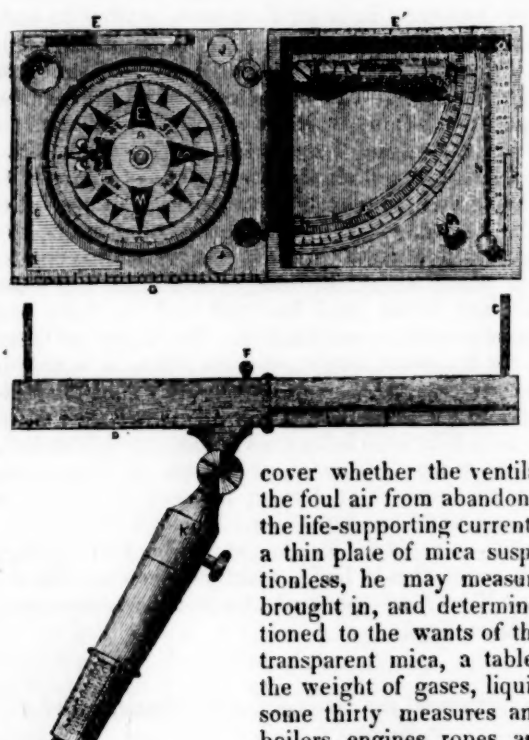
Description of a new Instrument for Geologists and Miners, called a "Metra." *

Whilst popular treatises bring each of the advances of science within the circle of "common things," efforts are making "*pari passu*" to simplify the means or the instruments by which observations may be taken. Many scientific instruments are already domesticated in the halls of England, and we may fairly expect that as each merchant captain records his observations for Lieutenant Maury's behoof, so travelers will

* From the Practical Mechanic's Journal, December, 1855.

go provided with measures of the powers of the earth, and of the air, for the benefit of some geological or other compiler.

A new instrument attracted much interest at the late meeting of the British Association, as offering to the traveler and engineer the means of taking most of those measurements which it is useful to record. Without sacrificing the strength necessary for constant use, or interfering with the accuracy of each portion, this instrument contains, in a brass case, three inches square, and little more than one inch thick, eleven different instruments. The traveler in distant lands can ascertain by its means the temperature, the force of the wind, the latitude, the position of the rocks, or survey and map his route. The geologist can determine and draw the direction and amount of dip of the rocks, the angles of cleavage and crystallization, the temperature of springs, or examine, by a plate of tourmaline, the bottoms of pools or shallow depths along coast lines, otherwise invisible to the eye. The miner, for whom chiefly this little instrument is intended, can moreover survey and level the roof or floor of his workings, and requires only a pencil to map them upon paper. It contains also a magnifying lens, and a measure of the wires in a Davy lamp. The miner can ascertain the temperature of the air under ground, and discover whether the ventilation is deficient, or if the foul air from abandoned workings leaks, into the life-supporting current. By the anemometer, a thin plate of mica suspended so as to be frictionless, he may measure the quantity of air brought in, and determine whether it is proportioned to the wants of the mine. Beneath the transparent mica, a table of constants exhibits the weight of gases, liquids, and solids, besides some thirty measures and formulæ for steam boilers, engines, ropes, and air. To exhibit the ingenuity displayed in this pocket instrument, it is sufficient to mention that it contains a clinometer, goniometer, level, double compass, plotting scales of various kinds, and an anemometer. Under the name of "Metra" it gained a medal at the last exhibition of the Society of Arts.



It was contrived by Mr. Herbert Mackworth, one of her Majesty's inspectors of mines, for his own use in underground observations.

The accompanying figs. 1 and 2, represent the plan and side view of the

metra when open and ready for use. A is the double compass, and B the level. The arc is graduated in degrees and in inches fall per yard. C the sights, D the scales, E the goniometer arm, and E′ the goniometer scale; F the plummet, G the lens, with a telescopic slide to measure the wire gauze; H the tourmaline, J the pivots on which the instrument stands, K are the two joints of the brass leg, by which the horizontality of the instrument can be obtained; L is a flat chisel point for entering joints of rock or masonry. This end unscrews, exposing a wood screw, M, by which the leg can be secured to a tree or a stand. N is the thermometer, O the screw which secures the top and bottom of the instrument together. Beneath the bottom, P, are placed the anemometer and the table of constants. The adjustments of the metra possess several novelties, with the view of shortening the operator's work. On this head we may allude to the plan of laying down the surveys on paper, without the aid of anything but a pencil, by first adjusting the north and south line of the plan by the compass, and fastening the paper down by weights. The compass then serves as a protractor, and by the engraved scales the distances are measured off. This method saves calculation and ruling parallel lines, and obviates some instrumental errors. The inventor states, that any dial or theodolite can be fixed to a scale, and used in a similar way as a protractor. The instrument is made by Mr. J. D. King, of Bristol, as well as a simpler form in box-wood, adapted for geologists.

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*Comparative Results Obtained from the Screw and Paddle-Wheel in the Steamships "Himalaya" and "Atrato."**

The performance of these vessels affords a valuable opportunity for comparing the relative efficiency of the screw and paddle-wheel as applied to large ocean steamers; and particularly so, as they are, with only one or two exceptions, the largest afloat, and approximate so closely to each other in size and speed. They are built of the same material, *iron;* commenced running in the same year and from the same port; and may be considered to offer, in all respects, a fair exposition of their respective systems of steam propulsion.

In one vessel, we have the direct-acting screw-engine of Messrs. Penn, simple, compact, and light; its screw propeller little more than 10 tons in weight, and yet fully equal to its task of transmitting the power of the engines for the propulsion of this huge ship.

On the other hand, there is the ponderous beam or side-lever engine, necessarily complex and bulky, with the feathering paddle-wheels, each probably weighing about 70 tons, and requiring enormous paddle-boxes and framing to support them.

In one case there are four screw-shaft bearings to look after and keep in order; in the other, 128 working parts requiring care and attention.

The first cost of the *Himalaya's* screw would be under £400; the feathering wheels of the *Atrato* would probably cost not less than £5000.

We will now give, in a tabular form, some dimensions of the vessels and their machinery, speed at measured mile, &c.:—

* From the Lond. Artizan, December, 1855.

VESSELS.	SCREW. *Himalaya.*	PADDLE. *Atrato.*
Built by	Mare, of Blackwall.	Caird, of Greenock.
Engines,	Penn & Co.	Caird.
Launched,	May 24, 1853.	April 26, 1853.
Length between perpendiculars,	340 ft. 6 in.	318 ft.
Ditto at load line,	336 ft. 6 in.	315 ft.
Breadth, extreme,	46 ft. 1 in.	42 ft.
Depth from underside spar-deck to top keel,	34 ft. 6 in.	36 ft.
Tonnage, B. M.,	3550 tons.	2721 tons.
Tonnage, register,	2327 8-100 t's.	2600 75-100 t's.
Stowage for coal,	1100 tons.	1440 tons.
MACHINERY.		
Nominal H. P. of engines,	700.	800.
Diameter of cylinders (effective),	77¾ in.	96 in.
Stroke of pistons,	3 ft. 6 in.	9 ft.
Cubic contents of both cylinders for one double stroke,	462 cubic ft.	1807 cub. ft.
Diameter of screw and of paddle-wheels,	18 ft.	36 ft. 6 in.
Number of blades and of floats in each wheel,	2.	15.
Length of screw and size of each float,	4 ft. 8 in.	12 ft. × 4 ft. 6 in.
Pitch of screw (uniform) is six times its length, or	28 ft.	
Total surface in screw-blades and in all floats of both wheels,	. .	1620 sq. ft.
Total number of boilers,	4.	4.
Total length of ditto, fore and aft,	43 ft. 6 in.	46 ft.
Breadth of ditto,	9 ft. 3 in.	12 ft.
Depth of ditto,	12 ft. 3 in.	18 ft. 9 in.
Number of furnaces,	24.	24.
Width of each,	2 ft. 10 in.	3 ft. 3 in.
Length of fire-bars,	7 ft.	7 ft.
Total area of fire-grate,	475 sq. ft.	546 sq. ft.
Total heating surface in boilers,	10,910 sq. ft.	16,640 sq. ft.
Total steam space,	2591 cubic ft.	2800 cub. ft.
Number of chimneys,	1.	2.
Diameter of each,	8 ft.	6 ft. 8 in.
Area of chimneys, total,	50¼ sq. ft.	70 sq. ft.
Pressure of steam in boilers,	14 lbs.	17 lbs.
TRIALS AT MEASURED MILE IN STOKE'S BAY.		
Date of trial,	Jan. 13, 1854.	Mar. 10, 1854.
Draft of water, forward and aft,	15 ft. 3 in. frd. 18 ft. 3 in. aft.	16 ft. 4 in. frd. 18 ft. 8 in. aft.
Ditto, mean,	16 ft. 9 in.	16 ft. 6 in.
Coal on board,	700 tons.	290 tons.
Speed of vessel in knots per hour, (mean of several runs,)	13·78 knots.	13·97 knots.
Ditto in statute miles, (ditto,)	15·87 miles.	16·08 miles.
Immersed midship section,	560 sq. ft.	544 sq. ft.
Displacement,	3220 tons.	3070 tons.
Revolutions of engines, (mean,)	59.	18½.
Gross Indicated H. P., (mean of all runs,)	2050.	3070.
Coefficient of I. M. S., or speed in knots per hour cubed × I. M. S. ÷ indicated H. P.,	716.	494.
Coefficient of displacement or speed in knots per hour cubed × cube-root of square of displacement ÷ indicated H. P.,	279.	171.
Slip of screw per cent.,	15.	
Ditto of paddles, taking axes of floats as centre of pressure,	. .	23.

The extraordinary fact which presses itself on our notice from the foregoing details of trials, consists, as it appears to us, in the difference of power required in the two vessels to produce a nearly identical speed. They are both built for the highest speed, and have fine lines, both in the forward and after bodies, the run of the *Himalaya* being longer and cleaner than the other, to suit the screw-propeller; and we must also remark that the *Atrato* had not been docked for some time previous to her trial, which was not the case with the *Himalaya*. But these circumstances will not by any means account for the *fact*, that 2050 H. P., economized by the screw, propelled the *Himalaya* at about the same speed as 3016 H. P., transmitted by paddles, propelled the *Atrato*. And the question naturally arises--By what means was the difference, or 966 H. P., absorbed or expended in the paddle steamer? And to this question we invite the earnest attention of our readers, for on its solution depends the extension of our knowledge of the screw-propeller, of the true nature of the action of which so little is thoroughly understood, as it in practice so often presents us with apparently anomalous results, and the value of which as a propeller for large ocean steamers (at any rate) has never been more prominent than in the example we have described.

In conclusion, we beg to say that, although we must decidedly express our opinion of the superiority of the screw over the paddle, as proved by the trials enumerated, it is our pleasing duty to bear ample testimony to the successful results obtained from both these noble vessels. They are magnificent specimens of naval architecture and of engineering skill, and both have highly distinguished themselves by their rapid voyages.

We will shortly lay before our readers some interesting investigations on the peculiarities developed by the screw of the *Himalaya* and other vessels.

On the construction of Buoys, Beacons, and other stationary floating bodies.

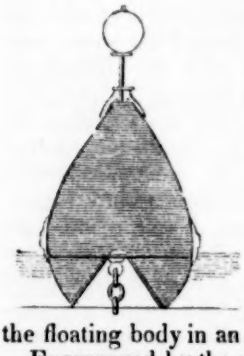
By Mr. G. Herbert.*

Floating sea marks, as ordinarily constructed, were, it was stated, admitted to possess the defect of riding uneasily on the waves, under which they were frequently buried, so as to be scarcely visible, when most required; besides which, it was not an uncommon circumstance, in heavy weather, to find that a buoy had broken its chain and floated away. The present form of the buoys, and the fact of the mooring chains being attached to a point far below the centre of gravity, sufficiently accounted for these and other acknowledged defects, and induced the proposition of a form of stationary floating body, which should have a tendency to ride easily, and to retain its perpendicularity,—whilst the point of attachment of the mooring chain would be in such a situation as to subject it to the least amount of strain, and not be liable to draw the buoy down into the trough of the waves. With this view a wrought iron pear-shaped buoy was constructed, of a circular form in plan, and terminating above in an apex; the distribution of the weight was such that the centre of

* From Newton's London Journal of Arts and Sciences, December, 1855.

gravity was situated a little below the centre of the plane of flotation; and the bottom was made concave and raised up internally, so as to form a cone, to the internal apex of which the mooring chain was attached.

This form was found so completely to answer the purpose, that several buoys were made by Messrs. Brown, Lennox & Co., for the Corporation of the Trinity House, and were pronounced to be superior to any previously built. A buoy 9 feet in height, 6 feet 6 inches in diameter, and having only 2 feet of the body submerged—exhibited, under all circumstances of wind and tide, an upright body of 7 feet out of the water. This quality of retaining its vertical position, arose from the force of the tide, or wave, being simultaneously exerted upon one side of the exterior of the buoy, and on the opposite side of the interior cone; the forces so nearly balancing each other as to retain the floating body in an almost perpendicular position.



Encouraged by the success of the first experiments, the Trinity House authorized the construction of a wrought iron sea beacon on the same principle. The floating base was 20 feet in diameter, divided by radiating bulk-heads into six water-tight compartments: it drew 4 feet 6 inches water, and supported a tower, also of wrought iron, 28 feet high, 7 feet diameter at the base, and 3 feet 6 inches diameter at the top—surmounted by an iron ball of the same diameter. This beacon was moored in the over-fall of the sea, at the South Sand Head of the Goodwin Sands, and was admitted to have been the best and most conspicuous sea-mark ever laid down. During very heavy storms it was observed, that the greatest angle assumed by the tower did not exceed 10° from the perpendicular, without any tendency towards circular motion. When it had been afloat for about five weeks, it was observed to sink gradually during very moderate weather, evidently from having sprung a leak. It was conjectured, that this casualty arose from the mooring chain having been improperly fixed in the hawse-pipe of the cone, instead of being below it, and thus that the links were brought into contact with the plates of the compartments, which, being only $\frac{3}{8}$ths-inch in thickness, were soon chafed through, probably in several places simultaneously,—and the several compartments becoming filled with water, the beacon was submerged. The recurrence of such casualties in similar structures could, in future, be easily remedied, by attaching the mooring to the proper point in the cone, as is done in the buoys,—and thus guarding against the possibility of any friction against the body of the water-tight compartments.

It was now proposed to carry out this principle of construction upon a larger scale,—and to erect upon the floating base a tower sufficiently large to serve as a substitute for a light-house. A plan for such a structure, as submitted to the Trinity House by Sir Charles Fox, was described. The floating base was 80 feet in diameter, and drew 20 feet water; the tower was 130 feet high, 24 feet in diameter at the base, and 14 feet at the lantern; the weight of the tower and lantern was 117 tons, and the total displacement of the whole building was 1602 tons,—the centre of gravity

being 2 feet 6 inches below the surface of the water. The weight of a double mooring chain, the links of which were $3\frac{1}{4}$ inches diameter, would be about 46 tons in about 30 fathoms of water, when under the greatest pressure of wind and tide; and the catenary curve would then be about 47° from the perpendicular. The extreme pressure to which the chain would be subjected afloat, would not exceed 92 tons. The security of this sea light-tower would depend upon its moorings, which, for greater certainty of holding, should probably be Mitchell's screw moorings, within certain limits of depth,—and if the chain, weighing 46 tons, was not considered sufficiently strong, any additional strength might be added, and would only have the effect of immersing the floating base a few inches more. In the event of any unforeseen occurrence causing the sea light-tower to break adrift, it could immediately, and with certainty, be brought up by a spare chain and anchor.

The extreme pressure of the wind upon this structure would not exceed 34 tons, and that would only cause the tower to incline about 1° 28′ from the perpendicular. The pressure caused by the speed of the tide, at four miles an hour, could be taken at 30 tons upon the immersed portion.

Some interesting observations, made by Mr. Douglass in 1853, at the request of the author, on the number, height, and speed of waves at the light-house in course of construction at Bishop Rock, the most westerly of the Scilly group, tended to confirm the opinion, that little or no inconvenience would result from the action of the waves, even in that exposed locality. The statement showed, generally, that waves which, when measured from the hollow to the unbroken crest, had a height of—

8 feet,	were in number	35	in one mile, and 8	per minute.
15 feet,	do.	5 & 6	do.	5 per minute.
20 feet,	do.	3	do.	4 per minute.

The new form of sea light-tower was proposed to mark the sites of shoals, or rocks, or islands, which were difficult of access. Light-houses for this purpose being generally required as warning, rather than as guiding lights, it usually was of little importance whether the light was exactly upon the point of rock from which it was intended to warn a vessel, or whether it was a short distance from it, so that the existence of the danger was made manifest.

It was submitted that this form of construction might be advantageously employed for "guiding" or "fair-way" lights. The problem of exhibiting lights of any considerable altitude in very deep water, had not hitherto been solved,—and, consequently, the majority of the lights now in existence were not those leading into a right channel, but those which warned from a wrong one,—and so long as that plan was followed, the system of lighting would be one-sided and defective. Practical men, however, now appeared to think that the old system should not be continued,—and as the sea light-tower was capable of being moored in any depth of water, however great, it might be placed midway in any channels, as an invitation to the right course, and thus insure to all vessels a safer and speedier navigation.

The light-house on the Skerryvore Rock occupied seven years in building, and cost upwads of £90,000; whereas, by means of the sea light-

tower, the same object might be accomplished in one year, at a cost of £30,000. The site of the Bell Rock could be equally efficiently marked, at a cost of about £20,000, instead of £60,000; and that of the Eddystone at about £15,000 instead of £40,000. And the new form of light-towers would possess the advantage of being accessible in all weathers.

The observations were limited to sea marks,—but if the principle of construction proved to be correct, it would evidently be applicable to floating forts, and to almost every other description of stationary floating body—several designs for which were exhibited.

November 20th, 1855.—In the discussion on Mr. Herbert's paper "*On the construction of buoys, beacons, and other stationary floating bodies*," it was generally admitted, that most favorable reports had been received relative to the buoys; they were moored in extremely exposed situations, where they had proved their superiority, by being always visible, and deviating but slightly from the perpendicular, at times when buoys of the old form were almost entirely submerged, and were only visible at intervals, in a horizontal position, in the trough of the sea. There was no reason why a larger class of beacons, on the same principle, should not be equally successful; and it was probable that it might be extended to supporting floating lights. The latter, however, demanded experiment.

The present light ships were stoutly-built vessels, moored by the bows; and in heavy weather, although, comparatively speaking, they rode easily, there was great strain upon the cables, which sometimes snapped. On one occasion there had been three light-ships adrift at the same time in the North Sea. That they were seaworthy vessels, was proved by all three getting safe into the neighboring ports; but the shipping was endangered by their absence. This tendency to snap the cable was contended to arise from the rising and tugging of the vessels moored by the bows, which could not be the case with a circular-formed body moored from the centre of flotation.

It was urged against the new form, that although the principle of the conical bottom was strictly correct, there was a doubt whether, if the circular base was lifted up sideways by one wave, the succeeding sea might not strike it on the under side, and severely try the mooring; also, that the lamps in a tower of that height, oscillating on the tops of waves, would be liable to be extinguished, and would not be so easily trimmed as on board light-ships, where they could be lowered down on to the deck and changed in a very short space of time. It was the great "send" of the wave that had a tendency to break the mooring-chains, and by this the circular light-tower would be peculiarly liable to be affected, on account of its light draft of water. If the system of mooring from the centre of gravity and of flotation was the best, why not adapt it to some extent to the present light vessels, by mooring them from about one-third of their length from the bows, and thus keep the head always to the "send" of the sea?

It might be apprehended, that there would be considerable difficulty in changing the mooring-chains of the sea light-towers, in such situations,—and it was well known that all chain moorings did require to be changed at intervals. Such heavy chains would require much stowing space, and considerable power to handle them; and in case of one of these circular

floating bodies breaking from its mooring, it would drift at the mercy of the waves.

It was admitted that, for a floating battery, the new form appeared to be peculiarly adapted, as the circular shape would enable the guns to be worked all round. It could be towed, or worked slowly by screw propellers into a convenient position, which the light draft of water would enable it to attain; the concave bottom and centre mooring would keep it steady,—it would afford but an indifferent mark for the enemy's guns,—and its dome-shaped circular upper works and deck, composed of thick plates, would resist any shot, however heavy.

In reply to the objections, it was argued, that if the principle was admitted to be correct for buoys and beacons, there was every reason to anticipate eventual success with the larger structures. It had been conceded, that the point of attachment was in the right position, and that the rising and falling of the tower on the waves, would not have any tendency to fracture the chain. Now, this vertical motion was all that the tower was subjected to, as the "send" of the sea never could act against the under side of the base: any force of a wave acting against the outside of the base, even when it was floating on the crest of a wave, would act almost as much against the inside of the inner cone, and thus tend to neutralize the force; whilst the great weight of the mooring chain always keeping it in a large curve, gave ample scope for the vertical rise and fall of the tide, or of heavy waves. If the vibration of the beacon at the South Sand Head had been so small, the anticipations of such extreme oscillation in a sea light-tower, with a proportionate extent of base, were hardly well founded; and even then there were mechanical means of meeting the difficulty. The system of mooring from the centre did not appear to be adaptable to vessel-formed bodies; and as to the apprehended danger from a wave striking the new form of tower on the broadside, it must first be shown where the broadside of a circular body was to be found. As to the difficulty of changing the mooring when necessary, and of handling the massive chains, there should never be an admission of any insurmountable difficulty in mechanical arrangements. The same intelligence which had devised the means of raising the Britannia tube to its present position, would contrive the method of lowering and replacing it when it became necessary; and in comparison with that tube, what was the weight of a mooring chain, even although the actual space within the base of the tower was restricted for handling it in? As to the danger from drifting away, no doubt the circular body would be less manageable than a light-ship, if the latter could get up her sails and get her head well up; but, on the other hand, there would not be so much danger of getting into the trough of the sea,—and a comparatively small anchor would fetch the sea light-tower up, when it had drifted nearly to the shore. The external form of the base might probably be modified, by giving it the same curvature inwards above the water-line as there was below it, so that the waves should not have any hold upon the mass.

The question of the applicability of the new form to floating batteries, had only been slightly alluded to in the paper, because it had not been tried; but it must be evident, even to the comprehension of landsmen, how many advantages it offered; and as it was now recommended by eminent naval authorities, it was hoped that it would be tried.

It was announced that the Board of Trade had determined to try the system, by placing a large beacon in a very exposed situation off the north-west coast of Ireland.

It was further urged that, hitherto, nautical men had not any actual experience of the effect of mooring a large body from the centre of gravity and of flotation. A ship moored from the bows, now met and received the full force of each wave with its nose held down to the blow, whilst the after-part was free to move in any direction. Now there could not be any analogy between the action of waves upon two bodies of such dissimilar forms moored under such totally different circumstances. If the buoys of the new form had been as successful as was admitted, why should not the principle be gradually extended, to ascertain the proper dimensions for the light towers? The success hitherto obtained, afforded the greatest encouragement to persevere in endeavoring to perfect a system which was calculated to be of the greatest benefit to the nautical world. The general adoption of fair-way, or guiding lights, for main channels, would, it was contended, form a new era in the system of lighting,—at once double the safety of navigation,—and be the means of saving many valuable lives.

It was questioned, whether the proposed system of mooring lights in the middle of channels would not induce the risk of collisions between them and vessels under sail; and it was principally the fear of risking the lives of the light-keepers in vessels of such novel form and untried capabilities, that had prevented the Trinity House from trying the larger structure, as they had tried the buoys and the beacon. They had also dreaded the difficulty of replacing the light-tower in its position, in the event of its breaking adrift,—whereas the present light-ships were more manageable under such circumstances: such occurrences were, however, rare, and on an average did not exceed one or one-and-a-half per annum,—the fact of three light-ships being adrift at one time being quite an exceptional case.

It was submitted that no unconquerable objections had been raised to the system, but it had, on the contrary, been admitted to possess many and great advantages. It was evident that it was only requisite to bring the united skill of the sailor and the engineer to bear upon the question, and the desired end would be attained.

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Description of a New Reflector for Lights.

Attention was directed to a new kind of reflector for lights: it was composed of silvered porcelain, and appeared to possess a very brilliant polish, which was stated to be indestructible. Hitherto reflectors of small sizes only had been produced, but by means now adopted, it was expected that they could be made as large as 21 inches in diameter over the mouth. If this manufacture was brought to the perfection that was anticipated, a great economy would result,—as the silvered copper reflectors at present used, were very expensive originally, were liable to oxidation, and were frequently injured by the carelessness of the attendants, in rubbing them to keep the reflecting surfaces bright. The new porcelain reflector had been transmitted by the Honorable Major Fitzmaurice to Capt. Washington, R. N., by whom it was introduced to the notice of the meeting.

For the Journal of the Franklin Institute.

On Hopkins's Self-acting and other Couplings for Cars. By Thomas D. Stetson, Mech. Eng.

The English method of securing railway carriages together without any "slack," except such as is derived from the elasticity of the springs introduced—has never been introduced to any considerable extent in this country. We have striven for a simple, cheap, and durable style, one which would readily lock and unlock, which would allow sufficient angularity of the cars to avoid straining on curves, and exhibit sufficient strength and elasticity to resist the ordinary forces, both of extension and compression. Although even the most modern forms differ in materials, in proportions, and in weight, there are certain features possessed in common, which are universally decreed to be desirable. Among these are flat or slightly rounded faces to receive the pressure when crowded together, a simple link to resist the more legitimate tensile strain when stretched by the locomotive, and a shank of uniform section to allow of end play through the stirrup which supports it. The material has been both cast and wrought iron, and on some roads several forms have been employed, in which the fusible has been made to embrace a portion of malleable metal so as to form a mongrel—a cast iron face connected to the spring behind, by means of round bars of rolled iron. The New Jersey Railroad and Transportation Company, have a large number of the latter description, some of the heads being provided with two, and others with four parallel bars. The cast iron couplings are liable to break in the shank, particularly in frosty weather—the wrought iron ones involve quite a large amount of labor in forging and securing of the head, but the greatest fault in all the couplings—when properly apportioned and attached—is the necessity for the presence of an active man between the cars to effect the union. The danger attending this operation is greater than any other to which employees are exposed, and this is much increased when the cars come together with rapidity, or in the night, so that several forms of self-locking couplings have been devised to remedy or alleviate this evil.

It is usually, and would seem almost *necessarily* the case, that mechanism of any kind, designed to accomplish more or to work better, costs more either in construction or maintenance than the older styles, but this objection does not apply to a new self-locking coupling recently introduced on the New York and Erie Road, a fact, of itself, sufficiently important to secure the immediate attention of economical as well as philanthropic managers.

Mr. David A. Hopkins, Elmira, New York, is entitled to the credit of this invention, which acts on the same general principles as the ordinary ones described, but is made self-acting by the addition of a small piece which supports the pin until the link has entered. The pin is placed in position by hand at any time previous to the approach of the cars together, and rests with its lower end supported by the spring piece. As the cars strike together in the act of coupling, the link—previously placed in the

draw-head of the other car—enters the mouth, thrusts back the spring-piece, allows the pin to drop into place, and the cars are coupled.

To facilitate the entrance of the link, the mouth is constructed in a flaring form like a tunnel, but this must not be carried to extreme as it impairs the resistance to compression and percussion.

The material employed is partly wrought and partly cast iron, analogous to those above described, but the wrought shaft is of flat rectangular iron like the corresponding portion of the ordinary coupling. It costs a trifle less than the wrought iron draw-head, and appears to be the strongest form yet devised, as the pin drops through the wrought iron portion as well as the casting. It allows an equal or somewhat greater difference in height of cars than does the ordinary coupling, possesses none of the complexity or delicacy usually supposed to belong of necessity to any self-acting contrivance, and in case of derangement or failure of the spring, may be employed in precisely the same manner as those now in general use. This latter quality is worthy of special note.

The invention, in short, includes two distinct improvements: first, a mode of constructing stronger and cheaper draw-heads by properly combining wrought and cast iron; and second, a spring-piece to support the pin and render the device self-locking. This piece is connected in the simplest possible manner, by means of a bolt playing endwise in the wooden portion of the shank. The improvement, in its present form, is only applicable where the shank is or may be filled with wood.

The device possesses one property not yet alluded to, which widely distinguishes it from all self-acting couplings before proposed. Until a connexion is made with another car, the link must be supported entirely by one draw-head in the common form, the overhanging end invariably declines in obedience to gravity. In Hopkins's draw-head the spring-piece aided by a suitable form of the throat supports the link in a horizontal position or at any angle in which it may be previously placed. This is a most important quality, as without it the link could only with difficulty be made to hit the mouth in the opposite face, when the unavoidable variation in the height of cars is considered.

There are usually two distinct steps in every important improvement, the first to add parts, the second to simplify. Self-adjusting couplings containing a multiplicity of mechanism have been frequently proposed; but in this simple device, simplification seems to have been carried to its utmost limits before its introduction to the public.

Remarks.—We do not question the simplicity or efficiency of the coupling described by our correspondent, but if he will refer to Vol. xvi, p. 70 of our *Journal*, he will find the description of one possessing all the advantages claimed for this, in addition to others which are not without their value. Ed.

AMERICAN PATENTS.

List of American Patents which issued from December 25th, 1855, to January 15th, 1856, (inclusive,) with Exemplifications.

DECEMBER 25.

113. For an *Improvement in Candle Mould Apparatus;* Lewis C. Ashley, Troy, New York.

Claim.—"The combination of candle moulds, which have an opening in the side or tip end of each mould, to admit the melted tallow, with a device for temporarily closing the large open ends of said moulds, and simultaneously entering the wicks thereat, to make the but ends of the candles with a smooth finish. Also, the combination of said combined moulds, and device for closing the side or tip ingate openings in said moulds, to complete the formation of the parts of the candles at said ingate openings, by which the operation of scraping to complete the finish of the candles at these places is avoided."

114. For an *Improvement in Pipes of a Vapor Bath;* Joseph Buhler, M. D., City of New York.

Claim.—"The back distributing pipe with its sleeve, operated by a cord with a handle and weight, or by any equivalent means, the said sleeve having perforations out of line with the perforations of the pipe, to allow the patient to direct the concentrated vapor to any part of his back."

115. For an *Improvement in the Combination of Injecting Syringes;* Joseph Buhler, M. D., City of New York.

Claim.—"The combination of the receiver and pumps, provided with cocks."

116. For an *Improvement in Cranes;* Benijah J. Burnett, City of New York.

Claim.—"1st, The pendant segmental traveler and backstays, arranged to spread outwards from towards the top downwards, and whereby the "tripping out," or lateral displacement of the foot of the crane or segmental traveler is obviated, all twisting or binding avoided, and a perfectly free but steady action given the same, either as regards pressure in the vertical direction transferred to the top of the tower, or horizontal swing. 2d, The combination and arrangement with the segmental traveler, or swinging foot of the crane, of the circular or revolving frame of anti-friction rollers freely suspended on the tower, and rotating round the same, together with the swinging foot, or segmental traveler, by the horizontal pressure of the latter on the rollers, in contact with their bite, on or against the fixed bolt surrounding the tower."

117. For an *Improvement in Time Indicators;* George Byington, Rochester, N. Y.

Claim.—"The wire or ribbon."

118. For an *Improvement in Double-Acting Steam Brake;* Robert L. Curry, Philadelphia, Pennsylvania.

Claim.—"The employment of a cylinder, in combination with the brakes, on both sides of the wheels."

119. For an *Improvement in Rotary Pumps;* Thomas Crane, Fort Atkinson, Wis.

Claim.—"The combination of the hinged valve, with the eccentrically moving round piston, when said valve is of the shape, and is so arranged in relation to the pump chamber, the offset chamber, the suction pipe, and the eduction pipe, as to render it impossible for said pipes to be, for an instant, brought into connexion with each other, during any portion of the revolution of the piston."

120. For an *Improvement in Window Shades;* Thomas Danforth, Roxbury, Mass.

Claim.—"Making the frame so as to be capable of longitudinal contraction and expansion, in combination with applying the gauze shade or curtain thereto, and so as to wind upon a roller, and be wound thereon."

121. For an *Improvement in Machinery for Whipping Hair;* Isaac Davis, Mechanicsburgh, Ohio.

Claim.—"A combination of a series of long, slender, and elastic revolving rods, with

a similiar series of stationary rods, arranged and operating within a cylinder, for the purpose of whipping hair. Also, in combination with the foregoing, a register in the bottom perforated head of the cylinder, for the purpose of regulating the strength of the downward current in the cylinder, and insuring a due admixture of air with the whipped hair, as it leaves the machine."

122. For an *Improved Method of Hanging Saws;* Soranus Dunham, North Bridgewater, Massachusetts.

Claim.—"The improved mode of hanging the saw, when the frame in which it is hung has a reciprocating curvilinear motion, so as to provide for the necessary play of the same at its ends; said improved mode consisting in supporting and confining the saw at one end, or both its ends, in wedge-shaped steps, arranged to tilt in proper grooves. Also, the vertical stiffening and regulating bar, with its ends arranged in the wedge-shaped steps, and with one end made susceptible of adjustment."

123. For an *Improvement in Steam Boiler Furnaces;* Henry F. and Louis A. Gossin, Thibodeaux, Louisiana.

Claim.—"Constructing the flues of boiler furnaces with cross walls, or diaphragms perforated with passages."

124. For an *Improved Manufacture of Wrought Iron Cannon;* John Griffin, Safe Harbor, Pennsylvania.

Claim.—"The manufacture of wrought iron cannon, by forming the fagot or pile of longitudinal bars, surrounded by a series of bands of iron, and the welding together the whole mass, by passing it between rollers."

125. For an *Improved Mode of Dressing Mill Stones, for Scouring and Hulling Buckwheat, &c.;* Bishop J. Harris, Auburn, Pennsylvania.

Claim.—"The smooth and beveled dress of mill stones, for scouring and hulling buckwheat, by which method, the buckwheat is longer retained within the bosom of the stones, and more effectually scoured, without injury to the kernel, than by any other known mode."

126. For an *Improvement in Seeding Machines;* Reuben Hurd, Spring Hill, Ill.

Claim.—"The arrangement of the elevator, or belt, with its buckets or seed cups, with the conveying spout and seed box, the latter being provided with a spring valve or movable bottom opening upwards; and the said cups or buckets passing through said bottom, exclusively in or during the upward travel of the elevator."

127. For an *Improvement in Apparatus for Making Salt;* John P. Hale, Kanawha Court House, Virginia.

Claim.—"The two pans or kettles, placed one over the other on a fulcrum, in combination with the vat."

128. For an *Improvement in Paddle Wheels;* Benjamin Hill, Rochester, N. Y.

Claim.—"The radially hinged valves used as substitutes for paddles; said valves being attached to disks or rings, and supported thereby."

129. For an *Improved Method of Hanging Circular Saws;* Westel W. Hurlbut, Boonville, New York.

Claim.—"The arms as connected with the saw guides, the bearing and the opening wedge, in such manner as to adjust with the movement of the saw."

130. For an *Improvement in Machines for Mincing Meat;* Alexander Lightheiser, Reading, Pennsylvania.

Claim.—"The placing of the knives or blades in an inclined position, on the surface of the cylinder, for the purpose of propelling the meat through the machine."

131. For an *Improvement in Hoisting Blocks;* William H. Merrill, Taunton, Mass.

Claim.—"The roll, the upper socket or cap, and the lower pintle or step, used together."

132. For an *Improvement in Hulling Machines;* Charles Miller, Carroll Township, Pennsylvania.

Claim.—"The application of the block and adjustable slides, by means of which, I

can regulate the machine, so as to retain the seed in the huller, until it is perfectly shelled."

133. For an *Improvement in Proportional Dividers;* Henry M. Parkhurst, Perth Amboy, New Jersey.

Claim.—"Providing an ordinary pair of dividers, with the secondary legs, which have their joints equidistant from the primary joint, and at right angles thereto."

134. For a *Combined Log and Sounding Line;* Adolphe Pécoul, Marseilles, France.

Claim.—"The sounding log, constructed, that is to say: composed of a buoy, having applied to it a weight, attached to a line passing between a pulley and a spring, or its equivalent, at the bottom; whether used with or without a connexion, to connec the line with the top part of it; the whole consituting an instrument, by which the speed of a vessel may be measured, by which soundings may be taken, without stopping or heaving to."

135. For an *Improvement in Fountain Pens;* Newell A. Prince, Brooklyn, N. Y.

Claim.—"1st, The elevator or bead, on the back part of the pen near its heel; being designed to keep the pen, by coming in contact with the inside of the main reservoir tube, from lifting too much. 2d, The pen notched near its heel, and the combination of the same with the feeding tube, correspondingly notched, so that the two placed together, and affixed in the main reservoir tube, the pen cannot get out of its position."

136. For an *Improvement in Mills for Grinding Grain, &c.;* Ezra Ripley, Troy, New York.

Claim.—"Combining with a continuous rotating grinding cylinder or plates, one or more grinding cylinders, which have a partially rotating reciprocating motion in opposite directions given to it or them by the cams, lever, and spring, (or by other analogous devices for the same purpose.")

137. For an *Improvement in Corn Shellers;* James Bobb, Lewistown, Pa.

Claim.—"The hood or casing, in combination with the concave fender board or cob arrester, and cylinder, for the purpose of directing a blast, and separating or cleaning the corn and cob."

138. *Improved Extension Bit;* John P. Rollins, Boston, Massachusetts.

Claim.—"The manner in which the lip and cutter are set, (or secured,) for operation, when being adjusted, without the use of separate screws for that purpose."

139. *Improvement in Revolving Fire Arms;* E. K. Root, Hartford, Conn.

Claim.—"Combining the driving pin that works in the grooves, to rotate and hold the breech in line with a slide below, adapted to the reception of, and to be operated by the trigger finger, and acting on the lock, at the end of the back motion, to liberate the cock or hammer, to discharge the load."

140. For an *Improvement in Looms for Weaving Wire;* George W. Smith, Mauch Chunk, Pennsylvania.

Claim.—"1st, Giving the reed two movements, the first for squaring the filling with the warp, and bringing it to a suitable position to be operated upon by the crimpers; and the second, to beat it up to its place. 2d, Giving the crimpers a movement laterally to the warp, in opposite directions, alternately, after the crimping operations, for the purpose of making them adapt themselves to the varying intersections of the successive wires of the filling and the warp."

141. For an *Improvement in Breech Loading Fire Arms;* Gilbert Smith, Buttermilk Falls, New York.

Claim.—"1st, The eccentric and traverse motions combined for opening and closing apertures, by means of a cap, perforated eccentric, to itself. 2d, Closing the aperture by means of an inserted screw pin being screwed forward direct from the cap, when the eccentric throws it direct over the axis of aperture."

142. For an *Improvement in Corn and Cob Mills;* Thomas B. Stout, Keyport, N. J.

Claim.—"The adjustable regulator, regulated and operating in connexion with the bur and shell. Also, coupling the spindle to the bur, and adjusting it therein, by means of the recess and pin, and the radial regulating rods, and in combination therewith, the

adjustment of the upper end of the spindle in the frame, by the rods or their equivalents, so that the two adjustments may harmonize with each other, and no disarrangement of the bur in its shell may arise, in the application of the power to the upper end of the spindle. Also, the auxiliary bur, dressed in the direction opposite to that of the main bur, and so arranged that it may revolve nearly or quite in contact with, and adapt its position to that of its shell, unrestrained by the parts by which it is attached and driven."

143. For an *Improvement in Hand Seed Planters;* Ancil Stickney, Concord, N. H.

Claim.—"Combining the plunger of said planter to any suitable portion of the seed box, by means of a spring, of sufficient thickness to prevent said plunger, in operating the planter, from sliding downwards on the seed box, and opening the planting receptacle, before said receptacle has penetrated to the desired depth into the ground, to deposit the seed contained in it."

144. For an *Improvement in Sad Iron Heaters;* Jesse D. Wheelock, Mayville, Wis.

Claim.—"The use or application of the spiral springs within the tubes, in combination with the tube and lids."

145. For an *Improvement in Hydraulic Oil Presses;* William Wilber, New Orleans, Louisiana.

Claim.—"The manner of constructing the cylinder of a hydraulic press, viz., of staves of wood, when lined with copper or other suitable metal as well as double banded. Also, the making of the bed plates of sections of wood, having the end of the grain of the wood in a line with the thrust with the piston or platen, for the purpose of using the elasticity of the wood, and thus relieving the press from the rigidity of metal and for lightness and cheapness of construction, and also, for enabling me to arrange the through bolts, so as to divide the strain upon them and prevent their crushing the wood. Also, the manner of uniting the through bolts or rods with the bed plates, viz., by means of the collars let into the separate sections of wood for relieving the heads of the bolts of the strain and distributing the strain throughout the bed plates. Also, in combination with the seed boxes, the introducing of steam directly into the seeds in said boxes, in contradistinction from heating them, by conduction or radiation, so as to have both heat and moisture in the boxes. Also, the hinging of the door and one of the sides of the box to the other sides, so that, drawing out the rod, the door of the box will spring away from the plates, and one side will, at the same time, give slightly but sufficiently to release the cakes from the said pressure, thus allowing them to be easily lifted out or removed."

146. For an *Improvement in Guards for Lanterns;* Charles H. Butterfield, Nashua, New Hampshire, Assignor to Amory Houghton, Boston, Massachusetts.

Claim.—"Mode of making the guard, viz., elastic or with springs at top and bottom, to embrace the neck and lower part of the lantern, the same not only dispensing with hinges, but serving to maintain the guard in place even when its clasp may be unhooked."

147. For an *Improvement in Revolving Grates;* Charles Evans, Charlestown, Mass., Assignor to self and George K. Goodwin, Roxbury, Massachusetts.

Claim.—"The method of hanging the cylinder within the recesses in the sides of the stove, and of raising the grate to its upright position."

Re-issues for December, 1855.

1. For a *Machine for Sticking Pins in Paper;* Samuel Slocum, Providence, Rhode Island; patented September 30, 1841; extended seven years from September 30, 1855; re-issued December 4, 1855.

Claim.—"Separating the pins, laterally, one by one from the lower end of a pile, sliding by gravity between guides by combining with such channel way between guides a grooved or notched instrument, so that when the groove or notch is brought in the line of the channel way, the lowest pin of the pile shall enter the groove or notch, and by the lateral motion, separate it from the pile without any conflict of the heads, the surface of the said instrument beyond the groove or notch acting as a stop to prevent the farther descent of the pile until a groove or notch be again brought in line, substantially as set forth. Also, the channel way between guides, for the descent of the column

of pins, by gravity, in combination with one or more guide grooves and one or more followers working in the said guide grooves, whereby the pins, after being separated, can be transferred. Also, in combination with one or more guide grooves and one follower connected therewith for guiding the pin or pins as pushed forward, the employment of a clamp or holder for clamping or holding the paper in the required position during the operation of inserting the pin or pins. And, finally, the combination of the channel way for the column of pins between guides, the guide, groove or grooves, or notches, the follower or followers, and the clamp, or equivalent therefor."

2. For an *Improvement in Mortising Machines;* Joseph Guild, Cincinnati, Ohio; patented November 30, 1852; re-issued December 11, 1855.

Claim.—1st, The sliding wrist connected with the chisel, and, also, with the driving power, in combination with the mechanism, or its equivalent, for sliding said wrist, so that the operator can, during the motion of the machine, vary the depth of cut of the chisel, or cause it to be suspended without disconnecting the driving power. 2d, The combination in a mortising machine of treadle and opposing spring or weight, connected to a toggle, one end of which being pivoted to the frame, the other is pivoted to a sliding wrist upon a vibrating arm, actuated by the power, the said wrist being slid out and in upon the arm with varying power and speed by the action of said toggle and its attached weight or spring and treadle."

3. For an *Improvement in Reaping and Mowing Machines;* Samuel Rockafellow, Coatsville, Pennsylvania; patented July 3, 1855; re-issued December 11, 1855.

Claim.—"Raising and depressing the finger bar, and, consequently, the cutters by means of the vertical bars, having wheels at their lower ends, arm attached to the crosspiece of the bars, lever, and shaft, with its arm attached. Also, supporting the ends of the stationary cutters by means of the sockets, or their equivalents, in the knobs or projections of the fingers."

4. For an *Improvement in Spark Arresters;* Wm. C. Grimes, Philadelphia, Pa.; patented February 12, 1842; re-issued December 25, 1855.

Claim.—"The combination of the central chamber, the series of tangential openings, the larger circular chamber furnished with a series of vertical openings leading into exterior chambers or channels, for separating sparks and other particles of matter from the gaseous current discharged from locomotive and other chimneys."

5. For an *Improvement in Sofa Bedsteads;* Charles F. Martin, Boston, Massachusetts; patented June 6, 1854; re-issued December 25, 1855.

Claim.—"Drawing down or depressing the cushion at the joint between the back and seat by means of the cords, or their equivalents, connected automatically with the seat and back."

DESIGNS.

1. For *Parlor Stoves to Burn Wood;* Conrad Harris and Paul W. Zoiner, Cincinnati, Ohio, December 11, 1855.

Claim.—"The design, configuration, and arrangement of the several ornaments, to be known and called 'Parlor Gem.'"

2. For *Clock Frames;* Jonathan C. Brown, Bristol, Connecticut, December 11, 1855.

Claim.—"The combination of the octagon form with the oval corner, as distinguished from some other form."

3. For a *Parlor Stove to Burn Coal;* Conrad Harris and Paul W. Zoiner, Cincinnati, Ohio, December 11, 1855.

Claim.—"The design, configuration, and arrangement of the several ornaments for a coal parlor stove, to be known and called the 'Carbon.'"

4. For *Six Plate Box Stoves;* Conrad Harris and Paul W. Zoiner, Cincinnati, Ohio, December 11, 1855.

Claim.—"The mouldings, flutes, and scrolls, to form an ornamental design for six plate or box stoves."

5. For *Cooking Stoves;* Conrad Harris and Paul W. Zoiner, Cincinnati, Ohio, December, 11, 1855.

Claim.—"The configuration and arrangement of the several ornaments, forming a new and original design for premium cook stoves, to be known and called the 'Kanzas.'"

6. For *Strap Hinges;* Enoch Woolman, Damascoville, Ohio, December, 11, 1855.

Claim.—"The design for strap hinges to be made of malleable cast iron, ornamented by the straight, curved, and annular ribs."

7. For *Ships' Caboose Stoves;* A. A. Lincoln, Jr., Norton, Massachusetts.

Claim.—"The new design for a cooking stove, consisting of the bar moldings, rivets, and bead or scolloped moulding."

8. For *Table Knives and Forks;* Joseph W. Gardiner, Assignor to Lamson, Goodnow & Co., Shelburne Falls, Massachusetts, December 25, 1855.

Claim.—"The part marked."

JANUARY 1, 1856.

1. For an *Improvement in Furnace for Soldering;* Philo Brown, Waterbury, Conn.

Claim.—"Combining the brazing or soldering chamber with the fire chamber and chimney, and interposed between the two, when the said brazing or soldering chamber communicates with the fire chamber by means of one or more apertures at or near the top, and one or more apertures at or near the bottom, governed by dampers, or equivalents therefor."

2. For an *Improved Chain for Power Press;* Nathan Chapman, Mystic River, Conn.

Claim.—"The so making of a chain for power presses, as that it shall recede gradually from a straight line, and the links diminish in length as they extend from the wheel on which they are to be wound to the follower."

3. For an *Improved Method of Operating and Lubricating Slide Valves;* James Cochrane, City of New York.

Claim.—"1st, Moving a vibrating flap or curved slide valve within its chest without the necessity of a stuffing box. 2d, The method of lubricating slide valves by and through an aperture of the valve or its seat."

4. For an *Improved Nut Box;* Richard Cole, St. Louis, Missouri.

Claim.—"The arrangement of the segments, the eccentrics, and the set screws with each other and with the case."

5. For an *Improvement in Brick Presses;* John B. Collen, Reading, Pa.

Claim.—"The employment of stationary mould boxes, in combination with the vertically moving gate (actuated substantially as set forth) and the intermittent action of the pistons, whereby the brick is pressed and delivered by a single piston."

6. For an *Improvement in Ploughs;* George W. Cooper, Ogeechee, Georgia.

Claim.—"Uniting the handles of the plough to the standard thereof by means of the self-adjusting elbow joint, so that both the handles and the plough shall be susceptible of the same relative adjustment to the beam."

7. For an *Improvement in Safety Guards for Railroad Cars;* John G. Crocker, Utica, New York.

Claim.—"The shield and the movable platform to be attached to railroad cars for preventing accidents, and though both are necessary to effect this purpose fully, yet I claim them separately as well as in combination."

8. For a *Wind Mill;* Benjamin Fenn, Hartford, Ohio.

Claim.—"The horizontal movable wing with unequal sides and hung upon eccentric pivots, in combination with the governor. Also, the method of governing and releasing the wings in high winds by means of the pendulum and rod, in combination with the wheel or counter balance."

9. For an *Improved Printing Press;* George P. Gordon, City of New York.

Claim.—"1st, Combining with such rotating disk and annular disk, which shall re-

volve around and in a contrary direction to it (for the purpose of distributing the ink.) 2d, Throwing the same rollers, one or more, used for inking the form, from the parallel position they necessarily occupy for this purpose, to an oblique position, which shall give to them a lateral motion when in contact with the distributing disks, or equivalent. 3d, A rotating reciprocating cylinder or segment of a cylinder, in combination with a reciprocating bed, when such bed shall have a movement to and from such cylinder. 4th, So placing the bed when used with a rotating reciprocating cylinder or segment of a cylinder which shall drop or pile the printed sheets underneath it."

10. For an *Improvement in Repeating Fire Arms;* Benjamin Grooms, Cumberland Township, Green County, Pennsylvania.

Claim.—"The mechanism for rotating the hammer during its reciprocating rectilinear movements, or rearward motions, consisting of the spring dog or stud, the series of straight grooves, and the series of helical grooves formed in the hammer shank, and arrangement with respect to each other, so that the spring dog may operate on them."

11. For a *Spoke Shave;* Elijah Holmes, Lynn, Massachusetts.

Claim.—"Supporting the ends of the knife or planes on shoulders inclined or arranged with respect to the bearing of the stock, and so as to enable the distance of the cutting edge of the knife from the said bearing surface to be changed."

12. For an *Improvement in Shirt Collars;* Walter Hunt, City of New York.

Claim.—"Uniting only the extremities of the lower edges of the pieces to the neck band, by means of any suitable fastenings, for the purpose of enabling a flat sided collar to fit easily and gracefully about the face."

13. For an *Improvement in Machines for Pegging Boots and Shoes;* Waterman B. Johnson, Sandwich, New Hampshire.

Claim.—"1st, The vibrating jaws for feeding the shoe. 2d, The combination of lever, stop, and swinging jack, for submitting the surface of the sole to the awl, to a given angle in every position. 3d. The adjustment of the drivers on the perimeter of the cam. 4th, The double binding slide clamps for securing the last in the jack."

14. For an *Improvement in Smoke Houses;* Moses Kendall, Cincinnati, Ohio.

Claim.—"The smoke furnace, or its equivalent, and its application to smoke houses thereof, which will prevent the fire from reaching the meat or the grease from reaching the fire, thereby preventing damage to the meat and smoke house."

15. For an *Improvement in Sewing Machines;* Phineas L. Slayton, Madison, Ind.

Claim.—"1st, The horizontal motion of the needle and shuttle box combined at any required distance from the cloth. 2d, The combination of mechanism, by which the pattern receives motion and operates to control the movements of the needle and shuttle, consisting of the worm wheel and screw, or their equivalents, of which the screw or their first mover is furnished with arms operated upon by a lever on a shaft which receives a continuous rotary motion. 3d, Furnishing the revolving shuttle with a revolving bobbin or ball containing the thread and spool, by which the twist of the thread remains unchanged, or their equivalents. 4th, The manner of connecting the fly with the feeding hook, as it is so operated upon by the thread as the shuttle passes through the loop to prevent missing stitches. 5th, The feeding apparatus attached to the revolving turn table."

16. For an *Improved Gold Amalgamator;* Daniel Liebee, Middletown, Ohio.

Claim.—"The use of the reservoir and spout, in connexion with the revolving pan and scrapers, operating with the stationary trough and agitators."

17. For an *Improved Pump;* Charles N. Lewis, Seneca Falls, New York.

Claim.—"The basin, or its equivalent, and in combination and connexien therewith, the arrangement and construction of said pump."

18. For an *Improved Machine for Making Eave Troughs;* Orson E. Mallory, Castile, New York.

Claim.—"The use of the semi-cylindrical shaft, metallic sliding bar, and the end rollers."

19. For an *Improvement in Harvesters;* John H. Manny, Rockford, Illinois.

Claim.—"The tongue with an adjustable joint."

20. For an *Improved Bed for Lath Sawing Machines;* Thomas R. Markillie, Winchester, Illinois.

Claim.—"The combination of the bed with the longitudinal bearing guides. Also, the construction of the conformable dogs."

21. For an *Improved Sash Lock;* Joseph Marsh, Rochester, N. Y.

Claim.—"The construction and arrangement of the plates, the lever, and bolt, said bolt having the secondary locking notch at *d*."

22. For a *Pump;* James Neal and Charles W. Emery, Boston, Massachusetts.

Claim.—"Supporting the brake posts by means of an annular ring made to encircle and rotate on the neck of the base plate and be screwed or fastened to it."

23. For an *Improved Padlock;* I. J. Oldis, Wheeler, New York.

Claim.—"The use of spring, catch, and lever, arranged and operating in connexion with the lips and springs."

24. For an *Improvement in Hay and Cotton Presses;* Joseph Peevy, Passadumkeag, Maine.

Claim.—"The combination of the laterally moving beam with the swinging follower."

25. For an *Improvement in Automatic Electoral Circuit Breakers;* Charles Robinson and Charles T. Chester, City of New York.

Claim.—"The manner in which the detent of the clock work is let down to take effect, viz: by means of the lever pushing back a spring, which previously held the detent in its elevated position."

26. For an *Improvement in Steam Boiler Alarms;* Thomas Stubblefield, Columbus, Georgia.

Claim.—"The combination of the flexible lever with the float and alarm valve."

27. For an *Improvement in Repeating Magazine Fire Arms;* John C. Smith, Camden, New Jersey.

Claim.—"1st, The trigger with its spring link, lever with its dog and projection; the hammer with its notch for receiving the dog, its projection and spring, the lever link with its spring; lever, link, and lever, or the equivalents to the above, in combination with the vibrating breech, the whole being constructed and arranged for the purpose of imparting to the said breech the required lateral vibrating movement, retaining the same when required, and operating the hammer so as to discharge the load by simply operating the trigger only. 2d, The magazine containing the cylinder with its hollowed flanches and spring catches, in combination with the ratchet teeth on the cross-piece, and the ratchet wheel on the end of a vibrating breech, so that the movements of the latter may cause the said cylinder to carry round in succession a cartridge ready for insertion into the chamber of the breech. 3d, The sliding rod with its rod and projection, for the purpose of allowing the operator a ready means of inserting the cartridges into the chamber. 4th, The cap reservoir with the cylinder and its orifice for receiving the caps, in combination with the rod, arranged for the purpose of readily placing the caps on the nipple of the breach."

28. For an *Improvement in Velocimeters for Vessels;* Ira F. Thompson, City of New York.

Claim.—"1st, The combination of a water leaking piston or pistons with the drag, whereby the drag being hinged at or near the bottom of the vessel, indicates by its inclination the speed of the vessel, and said water leaking piston or pistons act to prevent a sudden motion to said drag, as the vessel pitches. 2d, The method of communicating motion from the drag or paddle to an indicator by means of the link guides, and retained vertically by the arm."

29. For an *Improvement in Grain Binders for Harvesters;* George W. N. Yost, Fort Gibson, Miss.

Claim.—"The double reciprocating compresser for gathering and compressing the grain against the stationary compressers ready for binding."

30. For an *Improvement in Compositions for Treating Wool;* Andrew H. Ward, Jr., Boston, Mass.

Claim.—"The employment of neutral salts with the alkaline carbonates and the oleic acid."

31. For an *Improved Arrangement of Feed Rollers for Planing Machines;* Hiram C. Wright, Worcester, Mass.

Claim.—"Governing the motion of the movable feed rolls by means of the jointed levers and connecting rod or its equivalent, whereby I am enabled to keep their surfaces parallel with the middle one, and thereby feed the board on a line with the surface of the table."

32. For a *Hydro-Pneumatic Pump for Diving Bells;* George Williamson, Brooklyn, New York.

Claim.—"1st, The arrangement and combination of the pump cylinder, chamber, and their valve arrangement, by which a proper supply of water is kept up and the air pumped. 2d, Refrigerating the air by extracting the caloric therefrom after it has passed the pump, by means of the water bath surrounding the valve chamber, and eduction tubes. 3d, The float reservoir, connected with the eduction pipe for separating the water from the air."

33. For an *Improvement in the Manufacture of Leather Shoe Binding;* Joshua Turner, Charlestown, Mass., Assignor to W. Covel, Dedham, Mass.

Claim.—"The improved process in the manufacture of leather bindings, viz: dividing a sheet of leather into strips of equal widths, joining or connecting them at their ends, so as to connect them into one long strip, coloring the same when so formed, and finally splitting it so as to remove the fleshy surplus portion, and reduce the whole to one equal thickness."

34. For an *Improvement in Screw Machines;* Cullen Whipple, Assignor to the New England Screw Company, Providence, R. I.

Claim.—"The combination of a series of grooves, in a moving surface, with a smooth guard and griping plate. Also, the nicking saw mounted on the oscillating eccentric bearing resting in cylindrical boxes, in combination with mechanism for preventing and holding the blank."

35. For an *Improvement in Treating Oils;* Philo Marsh, South Adams, Mass., Assignor to Marsh & Howland, South Action, Massachusetts.

Claim.—"The purpose of defecating oil, the employment of the pyroligneic constituents of crude pyroligneous acid, except the acetic acid."

36. For an *Improvement in Harvester Raking Apparatus;* George A. Clarke, Assignor to William Clarke, Philadelphia, Pennsylvania.

Claim.—"Operating the rake by means of the endless belt, in combination with the levers, connected with the rods, for the purpose of raking the cut grain from the platform."

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37. For an *Improvement in Ploughs;* Benjamin F. Avery, Louisville, Kentucky.

Claim.—"The lock joint for holding the landside to the short landside and mould board, the same consisting mainly of a shaped projection, hook, and flanch, and their counterparts, in the short landside. Also, the ears or lugs, cast on the inside of the mould board, for the purpose of fastening the mould board handle."

38. For an *Improvement in Making Illuminating Gas;* N. Aubin, Albany, N. Y.

Claim.—"Mixing the materials from which the gas is to be generated, with porous or coarsely divided substances, which are slow conductors of heat, and introducing the mixture into the retort, in a vessel with a perforated bottom, so constructed as to compel the contents of the vessel, expelled by the heat, to escape at the lower end, near to or in contact with the bottom of the retort, where the heat is the most intense."

39. For an *Improvement in Harvesters;* Lebeus Barnes, Islip Township, N. Y.

Claim.—"The application to the reciprocating cutter bar of a mowing machine or reaper, of a spring or springs, driven by or operating in connexion with the cutter."

40. For an *Improved Mode of Hanging Double Doors;* Charles E. Brown, City of New York.

Claim.—"Connecting double doors, by an endless chain passing around pulleys on the shafts or axis of the doors or by gearing, arranged in any proper way, so that as one door is opened or closed, the other will be moved simultaneously in a similar or opposite direction."

41. For an *Improvement in Constructing the Bottoms of Ships and other Vessels;* Samuel W. Brown, Lowell, Massachusetts.

Claim.—"Making the entire bottom and keel of ships and other vessels, of thick and continuous plates of metal, for the united purposes of bottom and ballast."

42. For an *Improved Machine for Sheet Metal Bending;* Reuben Brady, City of New York.

Claim.—"Placing the upper roller in an adjustable or swinging frame, and attaching the guide or feeding plates to said frame, when the above parts are used in connexion and operate conjointly with the permanent roller and concave bed."

43. For an *Improvement in Coal Scuttle Covers;* Irah Chase, Jr., Boston, Mass.

Claim.—"1st, Hanging to the cover a circular hoop, in combination with the prop and receiving hole. 2d, The arrangement by which the cover is fastened down, *i. e.*, by making the projection of the hoop and the ear operate as an automatic latch."

44. For an *Improvement in Bee Hives;* George H. Clarke, East Washington, N. H.

Claim.—"The construction and arrangement of the hollow bars."

45. For an *Improvement in the Form of Building Bricks;* Edgar Conckling, Cincinnati, Ohio.

Claim.—"The bricks having marginal ribs, skirting three sides, and a central rib across the middle of the bottom surface, (or of the top and bottom surfaces thereof,) said ribs enclosing cavities adapted for the reception of grouting, in combination with coving on the inner edge, affording passage for the grouting from above, to the cavities below the bricks."

46. For an *Improvement in Disinfecting Fecal Matter;* Dominique Emile Coutaret, Boston, Massachusetts.

Claim.—"The use of the ingredients named, for deoxidising feculent or other decomposing organic matter, and converting said matter into a manure."

47. For an *Improvement in Street Paving Machines;* Thomas Davidson, Jr., Kensington, Pennsylvania.

Claim.—"The rammers operated by the lifting wheels, in combination with the ratchets and pawls, whereby the machine is moved along, either backwards or forwards, as the rammers perform their work. Also, the arrangement of the gearing, whereby the motive power employed to operate the rammers, may, by adjusting the wheel, be employed to drive the machine from place to place, when the rammers are not in operation."

48. For an *Improvement in Filing Saws;* Jacob Erdle, West Bloomfield, N. Y.

Claim.—"The use of the eccentric and the various parts co-operating therewith, for raising the file as it recedes, the lever, plate, and their connexions, for feeding the saw through one or more teeth, and for regulating the depth of the cut, and its angle."

49. For an *Improved Watch Key;* Morris Falkenan, City of New York, Morris Pollak and Solomon Wiener, Hoboken, New Jersey.

Claim.—"The key on the pipe, pressed into the groove by the spring, and sliding in said groove, which is closed at its outer end, and thereby causing said pipe to be turned by the case, compensating for wear, and also regulating the extent of motion of said pipe. Also, the trigger piece, combined with the stud spring, to remove said stud from the hole, and allow the pipe to be projected from the case."

50. For an *Improvement in Breech Loading Fire Arms;* L. H. Gibbs, Troy, N. Y.

Claim.—"Hanging the barrel at some point between the two ends, on a sliding and turning joint, in combination with the connecting of the said barrel of the turning and

sliding joint, by means of a joint link, with a hand lever, having its fulcrum in the stock or breech pin. Also, in combination with a sliding barrel, having the rear end thereof open, the employment of a fixed cylindrical breech pin, surrounded by an annular recess to receive the rounded edge of the barrel."

51. For an *Improvement in Attaching Hammer Heads to Shafts;* Charles Hammond, Philadelphia, Pennsylvania.

Claim.—"The socket with its projecting lips and the wedge, arranged and employed in connexion with the head and shaft."

52. For an *Improvement in Padlocks;* James Harrison, Jr., Milwaukie, Wis.

Claim.—"The combination of the shackle, sliding bolt and rods, and fitted within a solid body or case, constructed of suitable metal, whereby a strong, durable, and burglar proof lock is obtained."

53. For an *Improvement in Peg Cutters for Boots and Shoes;* Samuel R. Jones, Baltimore, Maryland.

Claim.—"The employment of the spring, in connexion with the curved surface of that end of the handle, (double levers) upon which the float is pivoted, for the purpose of rendering the float capable of self-adaptation to the surfaces to which it is applied."

54. For an *Improvement in Machinery for Making Weavers' Harness;* George L. Jenks, Providence, Rhode Island.

Claim.—"1st, The method of adapting the machine to the making of harness of different widths, by the application of movable head pieces of different forms, to the studs and its fellow, which form the end or outside studs of the range, and the application to the single depressers of a movable packing piece, and blocks or other variable guides. 2d, Guiding the operations of the arms which carry the fingers employed in forming the loops and knots to produce the eyes of the heddles, by means of a pin working in a slot in a plate, which is made variable by swinging on a stud, whereby the movement of the finger may be varied to any extent necessary, without varying its position, when in contact with its respective stud."

55. For an *Improvement in the Manufacture of Hats;* Joseph Johnson, New Orleans, Louisiana.

Claim.—"The application and use of the fabric in the construction of hat bodies, when the same is cut from the web, united together, and formed into hat bodies. Also, the metallic ring or annular plate, in combination with the "turn over" around the "square," for the purpose of preserving the proper circular form at the "square," when the fabric of which the "tip" is made is too light or thin to serve the purpose of such support."

56. For an *Improved Mode of Sawing Wet Fuel;* John F. Manahan, Lowell, Mass; ante-dated, July 8, 1855.

Claim.—"The method of producing from wet vegetable matter, an useful fuel, by mixing it with coal tar, or other fluid bituminous matter of like character."

57. For an *Improvement in Gas Cooking Stoves;* Hiram B. Musgrave, Cincinnati, Ohio.

Claim.—"In combination with the concentrically arranged gas deflector, the gas burner with lateral vents, and capable of vertical adjustment; or equivalent devices."

58. For an *Improvement in Cheese Presses;* William C. Pancost, Geneva Township, Ohio.

Claim.—"The spiral grooved wheel, in combination with the self-adjusting wheel."

59. For an *Improved Machine for Loading Dirt Cars;* Charles Phillips, Detroit, Michigan.

Claim.—"The framing, with boxes and aprons, or leaves attached to it.

60. For an *Improvement in Horse Hay Rakes;* Randall Pratt, Marple Township, Pa.

Claim.—"Hanging the prongs or clearers so that they can vibrate, and connecting them to the devices which operate the teeth, so that they will be vibrated in an opposite direction, simultaneously with the teeth, to clear them of the crop gathered, and press it together on the ground."

61. For an *Improvement in Excavating Machines;* J. J. Savage, City of New York.

Claim.—"1st, The connecting of the scoop and staff of excavating machines, to the swinging post, by vibratory or oscillating arms or links, or their mechanical equivalents. 2d, The adjustable broom, in combination with the excavating scoop and staff combined. 3d, The combination of the vibrating or oscillating connecting arms or bars of the scoop staff, with the feed chain, windlass, gearing and sheeve pulley, for the purpose of automatically feeding the scoop downwards, simultaneously with its forward motion."

62. For a *Method of Preventing Bank Notes, &c., from being Counterfeited;* Christopher D. Scropyan, New Haven, Connecticut.

Claim.—"The application of oil colored paper, together with a fugitive ink, to the manufacture of bank notes and drafts, which will prevent the counterfeiting of the said bank notes and drafts, by photographic process, by transferring on lithographic stone, or by anastatic printing; using for that purpose, the combined action of the oil colored paper, and the fugitive ink, *i. e.*, the combination of the oil colored paper and the fugitive ink, which produces the desired result, and not the oil colored paper alone without the fugitive ink, nor the fugitive ink alone without the oil colored paper, but the protecting power resulting out of the combination of the oil colored paper and the fugitive ink, or any other substantially the same."

63. For an *Improvement in Blades of Mowing Machines;* Gustavus Stone, Beloit, Wisconsin.

Claim.—"Making the sections of which the grass cutting blades are usually made of two pieces of steel, with but one cutting edge upon each, and so placing them upon the bar, that there shall be a wedged-shape opening between the backs, closed at the points, and widening out towards the bar."

64. For an *Improved Mortising Machine;* William Stoddard, Lowell, Mass.

Claim.—"1st, The movable cutting spurs or their mechanical equivalents, for forming or cutting the heads or ends of the mortise, and without the machine being confined to the timber being mortised. 2d, The double inverted feed rack, in combination with the ratchet nut, which is fixed to the screw, or their mechanical equivalents, so this screw can be moved by the rack and ratchet nut, to feed down the spurs, and reciprocating cutter, so as to form the mortise in the wood."

65. For an *Improvement in Machines for Sawing Marble Obelisks;* Abraham Straud, Melton, Pennsylvania.

Claim.—"The combination of the divided toggle jointed shaft, with a hinged or adjustable section of the frame, so that two or more saw frames hung to and driven by said shaft may be worked in an inclined position to each other, but at right angles to the axis of motion, and so that the shaft saw gates and their guides, as well as the sectional or hinged frame, may all be adjusted simultaneously and held in adjustment."

66. For an *Improvement in Seeding Machines;* John G. Snyder, Wheatfield, Pa.

Claim.—"1st, The so arranging the openings in the seeding plates, that the machine can be converted from a drilling to a hill planting one, or vice versa, by changing the running direction of the movable plate. 2d, An improvement upon the machine of Snyder & Young, patented Feb. 28, 1854, viz: the arrangement of the convex seeding plate segmental opening, and seed receptacle or drawer, for admitting of the location of said drawer outside of the hopper, and in a more convenient position for the attendant."

67. For an *Improvement in Candle Sticks;* Abner Whitely, Springfield, Ohio.

Claim.—"1st, The socket having the openings. 2d, The combination of the socket openings and slide."

68. For an *Improvement in Cultivating Ploughs;* William E. Wyche, Brookville, North Carolina.

Claim—"The arranging upon the share of the plough of one or more vertical cutters with a curved or inclined plate, at or near the rear outside of the share, for the purpose of dividing the furrow slice vertically, and turning the outer portion in towards the plough."

69. For an *Improvement in Corn Harvesters;* George W. N. Yost, Port Gibson, Mississippi.

Claim—"The combination of the adjustable lifters, finger board, revolving sickle-

shaped knives, vertical adjustable frame, and the adjustable platform, for the purpose of harvesting corn."

70. For an *Improvement in Fire Arms;* James H. Merrill, Baltimore, Md.

Claim.—"The construction of the breech pin with a receptacle for tallow to lubricate the joint. Also, the depression in the breech pin, opposite the end of the bore. Also, the combination of the button on one end of the breech pin and the slotted plate, in connexion with which the button works, to secure the breech pin firmly in place, while the breech is closed, in combination with a catch, or the equivalent thereof, at the opposite end of the breech pin from dropping out, while the breech is open and the button in a line with the slot; by which means the breech is securely closed, while the charge is exploded, and the pin at the same time capable of being readily removed. Also, the arrangement of the rammer in the rear of the breech, in combination with the breech pin. Also, the construction and arrangement of the breech pin, the lever for turning the same, the trough to receive the charge and guide the rammer, in such manner that the lever when shut down upon the stock, will cover and protect both the rammer and charging channel."

71. For an *Improvement in Mowing Machines;* Henry Pease, Assignor to self and James Roby, Brockport, New York.

Claim.—"The slotted arm and rotating knife."

72. For an *Improvement in Harvesters;* John Reily, Hart Prairie, Wisconsin, Assignor to Talbot C. Doneman, Ottawa, Wis., John Heath, Sullivan, Wis., and John Reily, Hart Prairie, Wisconsin.

Claim.—"1st, The method of raising and lowering the cutter bar. 2d, The arrangement and combination of a raker's seat with a swinging platform. 3d, The adjustable grain guard or straightening board."

73. For an *Improvement in the Manufacture of Boots and Shoes;* Sylvanus H. Whorf, Roxbury, Mass., Assignor to self and Charles Rice, Boston, Mass.

Claim.—"Extending the cement not only through perforations in the upper, but in or through perforations made in or through the insole or the outer sole, or both, the same presenting great advantages in not only securing the parts together, but rendering them water proof, when the cement employed is of a character to resist water."

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74. For an *Improvement in Means for Supporting the Propeller, and Receiving the Rudder of Stern Propellers;* John Beattie, Liverpool, England; patented in England, September 5, 1850.

Claim.—"The construction of an open wrought iron stern frame, forming part with the keel of the vessel, and receiving the rudder."

75. For a *Variable Dial for Dividing Engines;* William H. Brown, Worcester, Mass.

Claim.—"Causing both the index and dial to rotate at the same time."

76. For an *Improvement in Extension Railroad Car;* Joseph S. Brown, Lowell, Massachusetts.

Claim.—"Extending the floor and sides of cars outwards laterally, by means of the racks and pinions and other machinery connected to them, or otherwise, so as to give a larger area to the floor, and also enlarge the capacity of the car."

77. For a *Machine for Feeding Sheets of Paper to Printing Presses;* Samuel I. Chapman, Charleston, South Carolina.

Claim.—"1st, Separating and detaching the uppermost sheet of paper on the feed board, from those underneath it, and properly presenting said sheet to the fingers, nippers, or other device, by which it is conveyed to the printing press, or to the form thereon, by means of the box, valve, and holder or lifter, operating in connexion with a vacuum produced in the box, and a blast in the tube, the vacuum and blast being produced by an air pump, or its equivalent. 2d, Operating the feed board, by means of the cams, plate, spring, and socket, and screw rod fitting into said socket, motion being given the socket by means of a collar attached thereto, by a feather, whereby the feed board is made to rise and fall, to convey the sheets to the holder or lifter, and the diminishing height of the pile of paper compensated for, and also, any irregularity in

the thickness of the sheets. 3d, The feed board, in combination with the valve, holder, or lifter, and bar, operating in connexion with the vacuum produced in the box, and the blast in the tube."

78. For an *Improvement in Apparatus for Curing Varicocele, Sterility, Impotency, and other Diseases of the Genital Organs;* Joseph Cheever, Boston, Mass.

Claim.—"Combining the electric plates of an elastic scrotum sack, by chains, or such a series of electrical conductors, extending from one to the other, as will permit the necessary expansion or contraction of the sack to take place, without obstruction therefrom. Also, extending the connecting chain of the positive and negative plates, into and throughout one of the straps of the scrotum sack, and thence into and through the body belt, so as to protect said chain from injury."

79. For an *Improvement in Machines for Heading Bolts;* H. M. Clarke, New Britain, Connecticut.

Claim.—"1st, The arrangement of the two heading dies, when operating in such a manner, that while neither die is in motion nor at rest, without a like action of the other, the one, or internal heading die, receives an abrupt accelerated motion towards the close of the joint advance movement of the two dies, by means of the arrangement of the dies in the general slide, in combination with the lever or its equivalent, acting in concert therewith. 2d, Giving the gauge the several intermittent movements, upwards, downwards, and laterally, whereby, after performing its office of gauging, it moves away, to give room for the heading dies to operate, and afterwards, suddenly descends, to detach the bolt from the clamp, and by said action or blow, to clear itself of any adhering scale or dirt."

80. For an *Improvement in Removable Flanch Bars for Securing the Glasses to Lanterns;* Hezekiah Crout, Baltimore, Md.

Claim.—"The application of the flanched removable bar."

81. For an *Improvement in Heading Spikes;* Elisha H. Collier, Scituate, Mass.

Claim.—"Hanging the die plate or anvil upon centres or bearings, in such a manner that it can be reversed, or its under face brought uppermost, the said die plate or anvil being provided with a double set of die holes."

82. For an *Improved Method of Operating Fire Engines;* John P. Philo and George Cowing, Seneca Falls, New York.

Claim.—"The arrangement of the toggle, shaft, arm, and rods for operating the pistons."

83. For an *Improved Hydrant;* C. J. Cowperthwait, Philadelphia, Pa.

Claim.—"The cylinder fitted over the conical projection on the bottom of the case, said cylinder having valves within it, and an elastic cap or covering, through which the valve rod passes, and to which cap said rod is attached; the cylinder being secured on the conical projection by means of the bent rod and cap of the case."

84. For an *Improvement in Gas Burners;* Charles A. Cummings and Cortland Douglass, New London, Connecticut.

Claim.—"The interposition between two jets or streams of gas issuing from the same burner of a plate."

85. For an *Improvement in Lock Gate Valves;* Dewitt C. Cummings, Fulton, New York.

Claim.—"The arrangement and construction of valves or paddle gates for canal locks, whereby the sand and grit in the water is washed, and settles away from the bearings, instead of accumulating therein. Also, the stationary axis of the paddle, so secured to the framing that it may be turned when it becomes worn, so as to present a different portion of its surface to the bearing of the paddle."

86. For an *Improvement in Extension Tables;* Edward A. Curley, Westport, Conn.

Claim.—"Having the top of the main or stationary portion of the table made loose, and arranged upon or suspended by springs, and to move up and down in guides or ways."

87. For an *Improvement in Reefing Sails;* Henry D. P. Cunningham, Bury Hants, England; patented in England, November 30, 1850.

Claim.—"1st, The chafing spar, applied to the after side of the sail yard, for fending

off the sail from the mast or rigging, when rolled around the yard. 2d, The radius bar, in combination with the bonnet head, in order to permit the top of the bonnet to blow out in harmony with the belly of the sail."

88. For an *Improvement in Fire Arms;* Joseph C. Day, Hackettstown, N. J.

Claim.—"1st, The improved construction of the cap feeding tube with a slide on one side, a row of holes in said slide, and another row of holes in the side opposite; the one for the purpose of moving the follower along, and the other to prevent the follower returning with the slide. Also, communicating the motion from the tumbler to the slide, by a vibratory arm, or its equivalent, and also adding a spring thereto, in combination with the elbow slot, whereby said slide may be readily connected and disconnected from the lock and cap tube. Also, extending the lower part of the main spring from its pivot to and causing it to rest upon the sear, at a point very nearly over its centre, in order to dispense with a separate supporting stud and sear spring, and also, to enable the lower part of said main spring to be made nearly equal in length and strength to the upper part."

89. For an *Improved Mode of Attaching Thills to Axles;* Allen Greene, Providence, Rhode Island.

Claim.—"The use of the leather, gutta purcha, or other similar substance, in attaching the thill or shaft to the axle."

90. For an *Improvement in Implements for Pruning Trees;* W. W. Harvey, Saltville, Virginia.

Claim.—"Having the shank or bar of the cutter or chisel, fitted within a socket attached to a proper handle; the socket being allowed to slide or work on the shank or bar."

91. For an *Improvement in Cotton Presses;* Caleb S. Hunt, Bridgewater, Mass.

Claim.—"The peculiar arrangement of the respective parts of my improved press, by which I am enabled, with a single lever, to impart either a weak and rapid movement, or a slow and powerful movement to the platen of said press, or to any one of similar construction, viz: a non-revolving male screw attached to the platen, is embraced by two or more matched and movable concentric screw-nuts, whose uniting threads and grooves have a less degree of inclination than the threads upon the said male screw, and which are arranged in such a manner in relation to said male screw and the operating lever as to produce, at will, the desired movements of the platen."

92. For an *Improved Method of Regulating Speed of Wind-Mills;* Frank G. Johnson, Brooklyn, New York.

Claim.—"1st, The method of regulating the velocity of the wind-mill and controling the position of its fans, by the use of the weights with the springs, adjusted to slide from and towards the centre of the wheel upon the spokes, and connected to the fans, by means of the rods or their equivalents. 2d, The combination together of the brake wheel and the arms, for the purpose of setting the fans edgewise to the wind whenever desired."

93. For an *Improvement in Brick Machines;* Richard W. Jones, Green Castle, Ind.

Claim.—"Feeding the moulds underneath the grate and pressing roller, and discharging them therefrom, by means of the reciprocating carriage, springs, catch spring, and roller."

94. For a *Shingle Machine;* A. Kendall, Cleveland, Ohio.

Claim.—"1st, The arrangement of devices for operating the approximating knives, whereby the shingles are shaved to the desired taper, according to the length of the shingle. 2d, The manner of raising the driver from the slide to the slide, by means of the carriages acting on the arm on the end of the lever. 3d, The tumbler with the springs."

95. For an *Improvement in Grain and Grass Harvesters;* William F. Ketchum, Buffalo, New York.

Claim.—"Supporting the cutter bar and platform, when the implement is used as a grain harvester, by the bar or rod, in addition to the bar; said bar or rod being arranged or attached to the cutter bar and frame."

96. For a *Shingle Machine;* Samuel M. King, Lancaster, Pennsylvania.

Claim.—"The combination of cast iron boxes, with adjustable bottoms and sliding lids, operating with the knives in front alternately by connecting rods, so as to cut and regulate the size and taper of the shingle."

97. For an *Improved Steering Wheel Stopper;* William R. Lavender and Atkins Smith, Provincetown, Massachusetts.

Claim.—"Constructing a wheel stopper, and applying it so as to operate with the wheel and tiller, so that it may turn up and down on a hinge, and when down, embrace the wheel handle, and be supported laterally under the strain of the wheel."

98. For *Improved Bits for Boring Fellowes and Tenoning Spokes;* Horatio McGrath, Meigs Creek, Ohio.

Claim.—"The single twist auger, with a tapering shell pod, for the purpose of boring and tapering a mortise at one operation. Also, the tenon auger, with its auxiliary adjustable cutter, to reduce the superfluous timber, and with its finishing bits arranged to cut a tenon with a shoulder at right angles to its axis."

99. For a *Mortising Machine;* J. A. Merriman, Hinsdale, Massachusetts.

Claim.—"Operating the chisels and cutter by means of the reciprocating plates, attached to a plate and provided with slots, in which a pin attached to the wrist of a shaft works."

100. For an *Improvement in Safety Coal Hole Covers;* F. H. Moore, Boston, Mass.

Claim.—"The combination of the grating and rods with the cover."

101. For an *Improvement in Steam Stop-Valves;* James McNabb and Adam Carr, City of New York.

Claim.—"The attachment of the outer shell to the valve spindle, in such a way that it can be removed at pleasure, to repair the valve."

102. For an *Improvement in Machines for Dressing Mill Stones;* R. D. Nesmith, Lake Village, New Hampshire.

Claim.—"Securing the back end of the pick arm to a head attached to a sliding plate, the head being allowed to turn on the sliding plate, whereby the length of the pick arm may be increased or diminished, as desired, and also the position of the pick arm varied in the machine."

103. For a *Machine for Making Clothes Pins;* Ephraim Parker, Burlington, Iowa.

Claim.—"Attaching to a common lathe, a cutter working parallel with the mandrel, in connexion with a spout, the same motion operating both the cutter and spout. Also, in connexion with the above, a wheel and saw, the whole being a self-acting machine, taking square pieces of timber from the spout and converting them into cylinders and clothes pins, at a single operation. Also, the combination as above described, or any other combination substantially equivalent thereto."

104. For an *Improvement in Washboards;* Ira S. Parker, Sharon, Vermont.

Claim.—"Constructing the washboard of a series of cylindrical beaded bars, the ends of which are secured to boards, the beads of the bars being side by side in horizontal rows, so as to leave spaces between them."

105. For an *Improvement in Door Fastenings;* Reed Peck, Cortlandville, N. Y.

Claim.—"The combination of the spring with the gearing, by which the standard is rendered self-fastening."

106. For an *Improvement in Cargo Ports for Ships and other Vessels;* Charles Perley, City of New York.

Claim.—"The rim around the flanch that receives the bolts to secure the frame to the vessel; said rim receiving caulking on both sides, one against the vessel and the other against the shutter, thereby effectually preventing leakage."

107. For an *Improvement in Remelting Iron Scraps;* Abiel Pevy, Lowell, Mass.

Claim.—"My cast iron retaining vessel, with one or more perforations through it, or otherwise formed, the vessel being for receiving and retaining the iron dust, and then be enclosed on all sides, so that both the vessel and the cast iron dust it contains will be melted together."

108. For an *Improvement in Casting Metals;* Ezra Ripley, Troy, N. Y.

Claim.—"Instantaneously removing the air which ordinarily fills the mould, into an air-tight expansive chamber through crevice-like air passages, arranged for the purpose, immediately after the open mouth of the mould is immersed in the fluid metal."

109. For an *Improvement in Straw Cutters;* Samuel T. Sharp, Danville, Mo.

Claim.—"The arranging a circular knife and a circular guard upon a common pivot, so that they will revolve, one towards the other, until they meet, each traveling the same distance; or the arranging two knives (circular,) upon a common pivot, so that they will revolve towards each other until they meet."

110. For an *Improvement in Ditching Machines;* Thomas J. Stratton, Waterloo, New York.

Claim.—"The secondary frame movable about the main axle, and constituting the support of the excavating wheel, and of the earth conveyors, for adjusting the wheel to the required depth of excavation, and causing the conveyors to conform to each new position of the wheel."

111. For an *Improvement in Revolving Fire Arms;* Eben T. Star, City of N. Y.

Claim.—"Mounting the series of barrels on a central rotating spindle or arbor, provided with a breech plate, so that it can slide thereon, to be moved forward to receive the charges, and then pushed back and locked, to inclose the charge. Also, the method of elevating the cock, by the finger lever, until it is engaged and held by a spring catch in combination with the trigger, so arranged that it can be operated by the continued pull of the finger lever, to effect the discharge. Also, in combination with the finger lever and trigger, the employment of the shifting stop on the finger lever, so that it can be set, either to effect the discharge by the continued back pull on the finger lever, or by touching the trigger with the finger after the cock has been elevated."

112. For an *Improvement in Platform Scales;* Francis M. Strong and Thomas Ross, Vergennes, Vermont.

Claim.—"1st, The use of corresponding concavities and balls, in combination with the proximate face of the intermediate bearing pieces and the shoe. 2d, The adjustable bearings, in combination with the pivots. 3d, The combination of the projections on the bearings, with the notches in the pivots."

113. For an *Improvement in Yarn Dressing Frames;* Abner J. Sutherland, Lowell, Massachusetts.

Claim.—"The use and application of a lever, or its equivalent, one end of which presses on the surface of the yarn wound about the beam, and to the other end of which the friction spring is attached. Also, my let-off motion, only as applied to dressers and similar machines, excepting looms."

114. For an *Improvement in Machinery for Felting Hats;* James S. Taylor, Danbury, Connecticut.

Claim.—"The combination of machinery, for the purpose of giving the hat a rotary longitudinal and vibratory motion at one and the same time; thereby subjecting the hats, as they pass along the chamber between the rollers, to a kind of rubbing or friction, similar to the rubbing performed by hand, and therefore causing the hats to be felted in a more perfect and expeditious manner, than by the combination of any machinery ever before used."

115. For an *Improved Box for Coating Daguerreotype Plates;* Joseph H. Tompkins, Buffalo, New York.

Claim.—"The construction and use, in combination with the common coating box of the jar, with the porous diaphragm and the orifice, in connexion with the tube and flask, together with the compress and its application, for the purpose of impregnating the lime or any other substance for retaining chemical vapors in the coating box, with the vapor of bromine—and for the further purpose of continuously furnishing the chambers of the coating box with a more regular, uniform and consistent supply of the vapor of bromine, or any other sensetizing chemical."

116. For an *Improvement in Curtain Fixtures;* Lewis White, Hartford, Conn.

Claim.—"The lever pawl, in combination with the ratchet and cord, so constructed

and arranged, that by pulling the cord (which operates the roller to wind the curtain,) in different directions, or different angles, it will vibrate the lever pawl so as to hold or release the ratchet."

117. For an *Improvement in Oscillating Engines;* Hugh Wightman and William Warden, Alleghany, Pennsylvania.

Claim.—"The arrangement of the plummer block, in correspondence with the steam openings of the hollow trunnion of an oscillating steam engine, and the steam openings of a suitable valve, so that the plummer block lies contiguously between the trunnion and the valve, and furnishes more or less a seat, respectively, for the trunnion and the valve."

118. For an *Improvement in Means for Regulating and Working Steam Valves as Cut-offs;* Charles H. Brown and Charles Burleigh, Assignors to the "Putnam Machine Co.," Fitchburgh, Massachusetts.

Claim.—"Operating the valves by means of the revolving cams, in combination with the bent levers, and their combination with the governor."

119. For a *Lathe Machine;* John L. Brown, Assignor to self and Charles Learned, Indianapolis, Indiana.

Claim.—"The vertical guide frame, in combination with the adjustable reciprocating rest."

120. For an *Improvement in Grain and Grass Harvesters;* Gelston Sanford, and Thomas and Stephen Hull, Poughkeepsie, N. Y.

Claim—"Placing or hanging the axis of the driving wheel in circular bearings, which are allowed to turn in eyes, or straps attached to the frame—the axis being placed eccentrically, or out of centre in the bearings."

121. For an *Improvement in Hanging Mill Stones;* David Marsh, Bridgeport, Conn., Assignor to Thomas B. Stout, New Jersey, Joseph A. Cody, Ohio, and David Marsh, Connecticut.

Claim.—"The mode of securing the carrier of the spindle, by means of the vibrating feather inserted in the spindle; it admitting of being secured by keying in a recess in the cup."

122. For an *Improvement in Hydro-Carbon Vapor Apparatus;* Ari and Asahel Davis, Lowell, Mass., and Charles Cunningham, Nashua, N. H., Assignors to Alfred W. Adams, Lowell, Mass, Josiah B. Richardson and George W. Pettes, Boston, Mass., and Sherburne T. Sanborn, Winchester, Mass.

Claim.—"Employing the heat set free by the generation of the hydrogen, to heat the hydro-carbon used to impregnate the nascent gas."

Action in the Case of Interfering Patents.

To the Editor of the Journal of the Franklin Institute.

DEAR SIR:—The accompanying papers will, no doubt, prove interesting to many of the readers of your *Journal*, and especially to those who are concerned in patents.

Two patents for exactly similar inventions relating to grate bars were granted, one to Samuel Vansyckel, October 31st, 1854, and the other to J. C. Schlough, May 3d, 1855.

The following argument in favor of Schlough's claim, will give your readers an historical sketch of the entire case, and the decision of the Commissioner will serve to prove that the rights of real inventors are more efficiently protected than is generally supposed. As a preface, I forward the claims, illustrated with sketches of the three patents alluded to in the following papers.

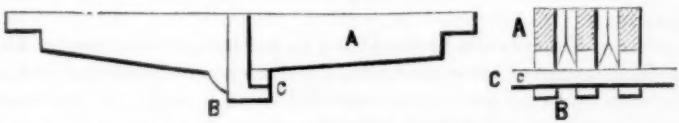
I am, Sir,

Respectfully, yours,

HENRY HOWSON.

Samuel Vansyckel's Patent, dated August 23d, 1853.

The nature of this invention consists in casting, or otherwise securing to the under sides of grate bars, hooks or catches, through which a rod or bar is passed and held, and by which the grate bars are prevented from warping or twisting by the heat, or from falling down if one end should slip off. A is the grate bar, B the catch or hook, C the bar.



Claim.—The construction of the above described grate bar as set forth.

Samuel Vansyckel's Patent, dated October 31st, 1854.

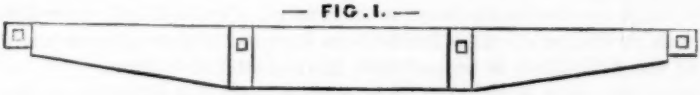
Claim.—The casting or forming of the pin, dowel, or catch in one bar or set, with a corresponding hole or its equivalent in the next bar or set, so that when put together, they shall be held from warping, twisting, or dropping from the end plates or walls, substantially as described.

—

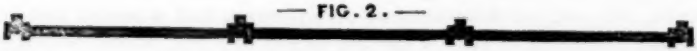
J. C. Schlough's Patent, dated May 3d, 1855.

Claim.—The mode of constructing grate bars for furnaces, with any convenient number of square or oblong tenons on one side, and a corresponding number of similarly shaped mortises on the opposite side, substantially in the manner described, and for the purpose specified.

— FIG. 1. —



— FIG. 2. —



— FIG. 3. —

—

Interference between Jacob C. Schlough and Samuel Vansyckel.

H. Howson's Argument in favor of the Claims of Schlough.

To the Commissioner of Patents.

Sir:—The applicant in this case is foreman in Templin's foundry, at Easton, Pa., having occupied that situation for a number of years.

Samuel Vansyckel, with one of whose patents Schlough's application has been declared to interfere, at present resides at New York, but was formerly engaged in the distilling business at Little York, New Jersey.

On the 23d of August, 1853, a patent was granted to Vansyckel for improvements in grate bars, represented in the specification as "having

a hook or catch underneath, through which a rod or bar is passed and held, by which the bars are prevented from warping or twisting by the heat."

These bars are generally known in the neighborhood of Easton, as the Vansyckel hooked bars, and this is the title given to them by the witnesses in their depositions taken on behalf of Schlough.

It appears that a number of these bars were cast at Templin's foundry, Easton, to the order of Vansyckel, both before and after the granting of his patent.

One set of Vansyckel's hooked bars, in particular, were used at Thompson's distillery near Easton, and from the evidence of Smith and McCauley, the fireman and engineer of that establishment, it is certain that considerable difficulties attended their adoption.

Schlough, as foreman in the foundry where Vansyckel had his hooked bars cast, was in the habit of superintending the men who put the bars in their places, and was consequently familiar with their construction, as well as with their defects, and naturally enough his thoughts were directed to supply a means of overcoming these defects.

Early in the Spring of 1854, Schlough hit upon the simple and efficacious plan of casting grate bars with a tenon on one side, and a corresponding mortise on the opposite side, so that a set of bars when thus placed together with the tenons fitting into the mortises, would maintain an uniform level, and would be prevented from warping and twisting when heated; an invention which evinces the results of the well directed thoughts of a practical mechanic.

Schlough by this inexpensive arrangement, obtained the same desirable ends as Vansyckel with his hooked bars, unattended, however, with any of the difficulties to be met with in the latter invention.

The exact date of Schlough's invention does not appear; we have, however, the positive testimony of J. Eyerman, that a model had been made and exhibited to him on the 5th or 6th of April, 1854. Schlough's invention had, therefore, assumed a practical and patentable form at that date.

About the same time, models of the mortise and tenon bars were shown to James Thompson, of Easton, who says, in his evidence, that approving of the plan, he ordered a set of full sized bars to be cast, in order to replace a set of the Vansyckel hooked bars, which had not answered the purpose well.

Now, this set of mortise and tenon bars *were* cast for Mr. Thompson at Templin's foundry, under the direction of Schlough, and were finished on the 20th of April, 1854. Young, who was at the time clerk in Templin's foundry, is positive as to this fact; he says, "They (the bars) were charged in my handwriting, the 20th of April; I suppose they were delivered on that date; I never entered any thing in this book that was not delivered." (Book produced.)

We now come to the receiving of these castings by James Thompson, who says, "We carted them away on the 20th of April, 1854; I have a memorandum book. In that book there is an entry that the bars were received on that date." (Book produced.)

It was usual at Thompson's distillery to replace the grate bars under-

neath the boilers on a Sunday, in order that the regular routine of work should not be interrupted during the remainder of the week.

Smith and McCauley, one the fireman, the other the engineer of the establishment, both swear distinctly to the fact, that the set of Schlough's mortise and tenon bars were put in their places on the Sunday following their delivery; and that they were in use with fire on them, on the Monday following, which was the 22d of April.

It is thus plainly evident, that Schlough had his invention reduced to a practical form on the 6th of April, 1854; that he had a set of full sized mortise and tenon bars cast and delivered on the 20th of April; and that, on the 22d of the same month, the bars were in actual use at Thompson's distillery.

Now, it appears from the testimony of Barnett, Young, and Hackett, that Vansyckel frequently visited Templin's foundry at Easton, on business relating to his patent hooked bars; it is also shown that he saw the pattern of Schlough's mortise and tenon bars, as prepared for Thompson's distillery.

James Hackett, the man who prepared the pattern, says, "He (Vansyckel) usually conversed with me on such occasions (during his visits). He saw a pattern of Schlough's mortise and tenon bar, which I think was for Mr. Thompson; he said that Jacob's bar, alluding to Schlough's, would suit for small furnaces, but not so well as his own hooked bars for larger furnaces.

From this significant remark, we may infer that Vansyckel had no intention of claiming the mortise and tenon bar as his own invention at that date.

In a subsequent conversation with Barnett, however, Vansyckel objected to the mortise and tenon bar, on the ground that it was the invention of a man in Louisiana (Armstrong), when books of reference had been produced, and examined, and it was discovered that the invention in question was in no respect similar to Schlough's; Vansyckel remarked "*in a casual manner*," says the witness, that he had *thought* of that too, alluding to the mortise and tenon. And it is quite possible that he may have *thought* of it. What inventor is there who on looking over a list of patents, does not repeatedly find some invention he had *thought* of before?

It has been now shown that Vansyckel had every opportunity of gaining information of Schlough's proceedings, information he did not fail eventually to turn to advantageous account.

On the 19th of June, 1854, not having the least intimation of Vansyckel's intention, Schlough applied for a patent; he is informed by your officer Vansyckel had applied for a patent for the same thing, on the 19th of May, just one month before.

An interference being declared, the depositions of seven witnesses for Schlough were taken at Easton, before Charles Buch, Esq., August 1st, 1854. Through inadvertence, however, witnesses to prove the fact of Schlough's mortise and tenon bars having been in operation before Vansyckel made his application were not called, a deficiency which the testimony adduced on behalf of Schlough for the present hearing amply supplies.

On the 10th of August, 1854, the depositions of two witnesses were taken for Vansyckel at New York; Schlough, and his then attorney, Mr. Green, being in attendance.

In your decision dated Sept. 13, priority is awarded to Vansyckel. It was Schlough's intention to appeal from this decision. Through the sickness of his agent at Washington, however, and the fact of Schlough being misinformed about the matter, the time for appealing elapsed, leaving him no other course but that of withdrawing his old application and filing a new one. This was accordingly done, and a notice dated January 30th, 1855, was received from your office, stating that Schlough's application had been adjudged to interfere with a patent granted to Vansyckel, Aug. 23d, 1853, that is, with the invention known as Vansyckel's *hooked bars*.

Thinking that a mistake had occurred in confounding one of Vansyckel's patents with the other, I as agent for Schlough, requested you to rectify the matter, which was immediately done, by sending a second notice, dated Feb. 3d, which stated that "the patent of Vansyckel with which Schlough's application interfered, was ordered to issue Oct. 16, 1854, and not Aug. 23d, 1853, thus setting the matter right."

On the 19th of March, 1855, I examined at the office of Charles Buch, Esq., Easton, the following witnesses: Young, Barnett, Eyerman, Hackett, Thompson, McCauley, and Smith. During the entire proceedings Vansyckel was present, accompanied by his attorney, who took notes, but declined in every instance to cross-examine.

As Schlough up to this time has received no notice of the hearing of witnesses on Vansyckel's behalf, and as the general hearing at the Patent Office is appointed to take place on the first Monday (the 7th of May), it has been deemed advisable to make out the present argument without further delay.

Vansyckel having virtually declined to notify Schlough, it is reasonable to infer that he intends to rest his case on the testimony adduced on his behalf for a previous hearing at New York, on the 10th of August, 1854.

The witnesses in this instance were William Vansyckel, a brother and partner of Samuel and William; Voorhies, a man in their employment. Both these men say, that in the month of March, 1853, Vansyckel made on pieces of paper, sketches illustrating a grate bar with mortise and tenons; sketches, which were afterwards swept away as waste paper, and consequently lost. They also say that *no formal drawing* was ever made.

Now, as to these sketches, there is no evidence to show that they were any more than mere crude hints casually thrown out; the very fact of sweeping them away shows the value at which they as well as the ideas they were supposed to represent were estimated. Had the sketches been preserved and produced, then there would have been some tangible information as to how far the conception had progressed towards an invention. In the absence of the sketches, it may naturally be inferred from the evidence, that the whole substance of Vansyckel's so-called invention in March, 1853, consisted of *a gossiping conversation between himself and his two witnesses, enlivened by sundry scribblings on scraps of waste paper.*

In support of this position, I would respectfully direct your attention

to the evidence of William Vansyckel. After stating in his examination that he had a perfect recollection of the sketches as illustrating mortises and tenons, he says under cross-examination, "*I can't tell whether the mortises and tenons extended into the side of the bar.*"

Could anything be more contradictory than this? The sketches must have been vague and obscure indeed, if they did not show whether the mortises and tenons extended into the side of the bar or not.

Both of Vansyckel's witnesses lay great stress on the fact, that he did not apply for a patent for the mortise and tenon bars, because he thought that it interfered with Armstrong's patent.

Now, Voorhies says, that Vansyckel showed him a letter describing Armstrong's patent, in the same month of March, 1853. Did this letter convince him (Vansyckel) that there was an infringement on Armstrong? If it did so convince him *then* that there *was* an infringement, surely the same conviction would have been as forcible *in May*, 1854, when he saw Schlough's pattern, as it was in March, 1853, and the reason why he should not apply for a patent (as derived from this mysterious letter), must have been just as strong at one time as the other.

If, on the contrary, this letter *did* convince him that there was no infringement, why did he not secure at once an invention so simple, inexpensive, and efficacious, as the mortise and tenon bar, which common sense must have shown him to be infinitely superior to the clumsy, costly, and imperfect hooked bar. The very fact of Vansyckel patenting his hooked bar in Aug., 1853, serves to sustain my former assertion as to the vagueness of the sketches, and to show that the undeveloped idea of mortises and tenons (if he ever had such an idea), was but of trifling consideration in Vansyckel's mind, compared with his hooked bars.

As for the letter from Washington upon which such stress is laid by the witnesses, and which they assert to have served as a guide for Vansyckel, the simple question is, *why was not that letter produced as evidence?* Why did not his attorney produce Vansyckel's correspondence with his agent at Washington on the subject?

John Eyerman says, "I am on intimate terms with Vansyckel; we have frequently talked on the subject of grate bars. *I never heard* Vansyckel in any of these conversations mention the subject of mortises and tenons in connexion with grate bars." Hackett says substantially the same. In fact, from the time of making the sketches, up to the time Vansyckel saw the full sized bar of Schlough's, he never made the slightest effort to secure a patent for the mortises and tenons.

The very first glimpse, however, of Schlough's bar, seemed to have convinced him of its superiority, and of the effect it would have upon the sale of his hooked bars, if Schlough's were once introduced into the market.

This, no doubt, induced Vansyckel to make application for a patent, resting his chances of procuring the same in case of opposition, on the obscure sketches said to have been made and lost fifteen months before.

Now, I would respectfully ask, ought these vague and undeveloped sketches on bits of scrap paper, which cannot be produced and sworn to, only by men whose position in regard to Vansyckel, must naturally tend to bias their minds in his favor, to have any weight against the well

matured, practical, and valuable invention of Schlough, an invention of which the testimony I have laid before you, testimony of respectable and unbiased witnesses, gives a succinct and truthful history.

Numerous authorities might be quoted showing why this should not be, and nothing bears more forcibly on this subject than section 7, in the rules and directions issued from your office, where it says, "Merely conceiving the idea of an improvement or machine, is not such an invention or discovery as above contemplated. The invention must have been reduced to a practical form, either by the construction of the machine itself, or of a model thereof, or at least by making a full drawing of it, before it will prevent a subsequent inventor from obtaining a patent."

With none of the above directions had Vansyckel complied.

More than this, at a recent date and since the granting of his patent, Vansyckel has endeavored to procure castings of Schlough's bars from Templin's foundry for samples, as fully proved by Barnett's terstimony, and by the letter put in as evidence, a fact which goes far to prove that even at the present time Vansyckel is unacquainted with the practical bearings of the bars in question.

It would be a hardship, indeed, if Vansyckel was allowed to reap the benefit of an invention of which he had not sense enough to see the superior advantages in the first instance, and which he was not mechanic enough to reduce to a practical result afterwards.

Schlough, therefore, as having put his invention into a practical form on the 6th of April, 1854, as having a set of bars in actual operation on the 22d of April, while Vansyckel did not make an application until the 19th of May: prays that a patent may be granted to him under the act of 1836, section 8, which empowers you as Commissioner (although a patent has been already granted to Vansyckel), to grant one to him (Schlough) likewise, and thus place both on an equal footing before the courts and the public.

I am, Sir, very respectfully, yours,

HENRY HOWSON, Agent for J. C. Schlough.

Interference between Jacob C. Schlough, & Samuel Vansyckel. } Grate Bars.

It seems that nearly a year since an interference was declared between these parties in relation to substantially the same subject matter. Priority of invention was awarded to Vansyckel; no appeal was taken, and the patent was accordingly issued. In January following, Schlough filed a new application, and a new interference was declared. Vansyckel has taken no testimony, relying on the previous trial and decision. Schlough has taken testimony, showing that his invention was substantially made prior to the filing of Vansyckel's application in this case. I think in the present condition of this case, it would be improper to take into consideration either the testimony given in the previous case or the decision then made. This is a new case, and must be decided by the testimony now produced. There is nothing to show sufficiently that there was a previous interference covering this same ground. But laying aside any technical objection of this kind, and admitting that the previous interference was for precisely the same subject matter as the present, I should not feel jus-

tified in considering this as *res-judicata* in the same manner as a decision in a trial at law is conclusive on the same subject when a second time put in controversy.

The reason is not the same. In the one case, full opportunity is given to each party to obtain full testimony, and it is presumed to be his fault if he does not present his case fully to the tribunal which is to adjudicate. In the other there is no means of *obtaining* testimony, except it be voluntarily given. Ample opportunity for obtaining justice is not provided, and the party has frequently no means of securing his just rights but by filing a new application. The law does not seem to contemplate that one adjudication shall be conclusive in relation to all subsequent trials, but that whenever an interference is declared, the Commissioner will satisfy himself which of the parties is the prior inventor; and after he has made his decision, an appeal lies to the Judge of the Circuit Court. Now, the decision of the Commissioner, should be governed by the same rules as will control the Judge on appeal, so that the decision, if made correctly by him, shall be affirmed by the Judge.

Suppose, then, in the present state of this case, priority were to be awarded to Vansyckel, and there should be an appeal taken to the Judge of the Circuit Court; can there be the least doubt of his reversing the decision, inasmuch as he would have no evidence whatever before him on which to sustain the decision awarding priority to Vansyckel. I am therefore, of the opinion, that priority must be awarded to Schlough, which is accordingly done.

Patent Office, May 15, 1855. C. Mason, *Commissioner*.

MECHANICS, PHYSICS, AND CHEMISTRY.

Note on various Phenomena of Oxygenation. By F. Kuhlmann.*

New Process of Formation of Sulphuric Acid.—It is well known that many hydrocarbons become resinified by contact with the air, in consequence of an absorption of oxygen. This is the case with most of the essential oils, and the drying oils undergo analogous modifications by a slow acidification; but it has not been suspected that these hydrocarbons, before undergoing any considerable modification in their constitution and properties, form, as it were, a provision of oxygen under such conditions, that when they come in contact with bodies which have the property of more immediately forming an intimate combination with oxygen, they yield the absorbed oxygen to the latter, and again acquire their original state, becoming again capable of attracting oxygen from the air. In these cases the resinifiable essential oils constitute sources of oxygen for the benefit of other bodies, and to a certain extent play the part taken by deutoxide of nitrogen in the manufacture of sulphuric acid.

When oil of turpentine is exposed to the air for a few days, and then agitated with a solution of sulphurous acid in water, the mixture becomes strongly heated, the temperature rises to 122° F., and even higher, and the sulphurous odor soon disappears, leaving only that of the tur-

*From the Lond. Chem. Gaz., No. 314.

pentine. In this reaction, which appears to be facilitated by the solar radiation, formation of sulphuric acid takes place at the expense of the oxygen absorbed by the turpentine, which is taken from it by the sulphurous acid before it has time to appropriate it in a more permanent manner.

If sulphurous acid gas be passed into a moist glass globe containing the vapor of an oxygenated essential oil, the sulphurous acid disappears by degrees; on the other hand, if a mixture of an aqueous solution of sulphurous acid and an aërated essential oil be allowed to become concentrated in contact with the air, the sulphuric acid formed carbonizes the essential oil without the necessity of raising the temperature of the mixture.

The oxygenating action of the aërated essential oil is not confined to sulphurous acid; it extends also to other acids, such as hyposulphurous acid, the sulphites, arsenious acid, &c.

Peculiar Reactions of the Essential Oils in Painting.—The essential oils, from the nature of their constituent principles, may be regarded as possessing naturally, and especially under the influence of heat or of the sun, a reducive power which acts slowly upon white lead and the colored oxides. However this may be, the resinifiable essential oils temporarily possess another property of an opposite nature, as I have just shown; and this deserves to be taken into consideration in the study of the modifications undergone by paintings in oil, namely, that of absorbing oxygen by mere contact with the air. The result of this is, that at the moment of their employment the essential oils may exercise an oxidizing action, tending to destroy vegetable colors and to modify some mineral colors. Thus:

Litharge, heated with aërated oil of turpentine, furnishes the puce-colored oxide of lead.

If oil of turpentine be agitated at the ordinary temperature with the hydrated protoxides of iron, tin, and manganese, these oxides pass to a higher degree of oxidation. With a solution of protosulphate of iron, basic sesquisulphate is produced, which separates from the liquid. The white precipitate formed by ferrocyanide of potassium with a protosalt of iron immediately acquires the intense color of prussian blue.

Blue and red flowers, decolorized by sulphurous acid, re-acquire their colors by contact with the aërated essential oil. The essential oil, freshly distilled, possesses no oxidizing power.

In the association of colors applicable to painting in oil, regard must therefore be had not only to the modifications which may be produced upon certain colors by the various mutual reactions of the coloring matters, but also to the oxidizing action of the essential oil, which must be manifested at the first moment of its application in the form of varnish.

General Considerations.—In all the reactions just referred to, the oil of turpentine, and in general the essences which are capable of absorbing oxygen from the air, behave as oxidants, the energy of which is sufficiently marked by the great elevation of temperature produced by the contact of the aërated essential oil with a solution of sulphurous acid.

It is important to ascertain whether this oxidizing property belongs to certain oils, and whether the proof of this fact may not account for the frequent spontaneous combustion of oiled tissues. Considerable interest

also attaches to the investigation of the action of the vapors of essential oils upon putrid miasmata, and the determination of the question whether, in these cases, there is not a combustion of the principles diffused in the air.

If oxygen can thus dissolve in certain liquids without combining, we are led to suppose that where it is disengaged it exerts its action upon the bodies with which it is in contact in the dissolved state before becoming gaseous. Are not the same circumstances presented in all the chemical reactions in which in our explanations we have recourse to the intervention of nascent gases?

Thus we shall be led to inquire whether other bodies do not share with certain essences in the power of forming a provision of oxygen, and yielding this reagent to assist in various reactions. This study may throw great light upon the phenomena of animal and vegetable physiology. The solution of oxygen in the blood by the act of respiration, and its subsequent assimilation, already present a great analogy to the phenomena which have just been described. As a question of health, it would be advisable to ascertain what may be the consequences of the respiration of air charged with essential oil in apartments newly varnished. On the other hand, we know how unfit water which has not been aërated is for good alimentation.—*Comptes Rendus*, Sept. 24, 1855, p. 470.

Remarks on the Smoke Question. By C. W. Williams.*

To the Editor of the Mechanics' Magazine.

(Continued from page 69.)

Conclusion 7. "That successful modes of preventing smoke, if there be proper *boiler surface*, may be adopted without the infringement of any patent right, the methods in question not having been patented, or the patents having expired."

With the exception of the words "if there be proper boiler surface," this conclusion is correct. It is true there have been numerous patents and contrivances for effecting the *consumption of smoke*, all of which necessarily were failures, as smoke cannot be consumed. There is, however, one mode, and one only, for effecting the *combustion of the gas*, whether generated in the furnace or the retort, namely, the bringing it into immediate contact with the proper quantity of air in the proper manner. This mode was patented by me in 1839. That patent being now expired, it has been introduced (but without acknowledgment) into many new patents; among these may be mentioned Woodcock's, Prideaux's, Parker's, and many others.

Conclusion 8. "That notwithstanding the obvious advantages of perfecting the combustion of fuel, such is the *indisposition of practical men to depart from the beaten track*, that nothing but the *force of law* is likely to ensure the care and attention necessary to protect the public, &c."

Nothing can be more correct than this conclusion. This "indisposition of practical men" arises from what Mr. Houldsworth (see his letter at

* From the Mechanics' Magazine, July, 1855.

page 16 of the Report of the Board of Health) considers as the "ignorance and prejudice" of the owners of furnaces. Ignorance of the principles which govern the laws of combustion, and prejudice, the accompaniment of such ignorance.

Manufacturers, and practical men in general, by neglecting to obtain the requisite information (perhaps because it involves something of chemical details), become thus dependent on others, and are ever at the mercy of their own servants and stokers, who have no interest to satisfy beyond that of saving their own labor. Whatever interferes with the easiest and laziest mode of managing a furnace, is sure to be condemned by the stoker, his employer being unable to detect the imposition. Now, the charging and managing a furnace, or of introducing the air, by which alone combustion can be effected, is as undeniably a part of *practical chemistry* as any of those numerous and minute details which fill the useful volume of "Faraday's Manipulations."

Conclusion. 9. "That though the absolute prohibition of smoke could not be enforced without compelling most of the owners of furnaces to incur very heavy expenses, its reduction to a very small amount may be effected with comparative ease, &c."

The conclusion with reference to the incuring "very heavy expenses," is here gratuitous and unwarranted. In truth, and speaking the result of great experience, it may be stated that the having "incurred very heavy expenses" is demonstrative evidence that the patentee of the invention applied was either ignorant of the simple process of nature in effecting combustion, and the facility with which that process can be carried out, or that the application of such costly or complicated apparatus as should involve "very heavy expenses," was mainly intended to give a color to or justify a high and commensurate charge and profit to the patentee.

Conclusion 10. "That the enforcement of smoke regulations can be most easily and quickly effected by the appointment of constables to keep a regular and constant watch upon all chimneys liable to emit much smoke; and that the prevention of smoke will be more quickly and certainly effected by *constant supervision and immediate information* of any breach of the regulations, than by heavy penalties irregularly imposed."

This is the soundest and most practically useful of the twelve conclusions to which the Board of Health have arrived. The appointment of "constables to keep a constant watch," is absolutely essential to the enforcement of regulations; while "*constant supervision and information*" are the only effective checks on that neglect and recurrence of mismanagement by which the evil would be continued. The authorities of Liverpool have wisely, though tardily, adopted this principle. They have appointed an official "*inspector of smoke nuisances.*" The result of even a few weeks of such supervision and "gentle legislative pressure," as Mr. Houldsworth expresses it, is too remarkable and undeniable to be questioned. On this head, and after many years of extensive practice, I can certify to the necessity of this constant and watchful supervision; nothing having thrown more difficulty in my way than the interested obstinacy of engineers and firemen, in adhering to their own lazy mode of

managing the furnaces, even of those employed in the numerous steam vessels under my own control. When to this is added the "indisposition of practical men" (the makers of boilers and furnaces) to depart from the beaten track, it can no longer be a matter of surprise that so little has been done in "perfecting the combustion of fuel." The mere stokers, and particularly in steam vessels, where they must necessarily be left to themselves, have it in their power to give apparent favorable results to their own modes and mismanagement, and plausibly to show them none other can supply the engine with the necessary quantity of pressure of steam.

Conclusion 11. "That great facility in the prevention of smoke would be afforded by the publications and descriptions of patented and other inventions for the prevention of smoke, by which those interested could be informed what they could and could not do in this matter, without infringing upon any patent right."

This is as impractical and useless a conclusion as the preceding one is practical and effective. Nothing, indeed, could be more certain of leading the public astray than the descriptions of even the patentees of their own respective plans. On this head more will be said hereafter.

Conclusion 12. "That great facility would also be afforded by the appointment of officers, specially qualified, and not connected with any patentee or manufacturer of boilers or furnaces, to superintend the police officers employed to suppress the nuisance of smoke, and to advise owners of furnaces how best to comply with the provisions of the law, and to report upon cases of its infringement."

This is a valuable suggestion. The difficulty, however, of carrying it out would, it is feared, be too great to render it generally available. The magistrate, in the discharge of his duty, is often unequal to the task of even appreciating the worth or truthfulness of the statements of the offending party; much less is he capable of offering advice, or suggesting a remedy, whether chemical or practical. The Admiralty Judge finds it necessary to have nautical men, as aids, or assessors, before he is qualified to decide on nautical distinctions. The civil judge, on the trial of offences in smoke-nuisance cases, should, in like manner, have an assessor; but he should be a chemical professor, seeing that the offence is as attributable to a breach of chemical laws or practice, as much as the improper steering a ship or mismanagement of sails would be a breach of nautical law or practice. Under the existing law, however, the magistrate is not called on for such strictly professional knowledge. With your permission, Sir, I propose hereafter to examine the general bearing and details of this important communication from the General Board of Health.

For the Journal of the Franklin Institute.

Electro-Chemical Engraving. By M. G. Derincenzi.

The author has been for some years employed in a series of researches on the art of printing and reproducing designs by engravings in relief, and by printing type. The following is a description of his method.

The best metal for this kind of engraving is zinc. It is employed in

thin sheets, which are grained with sifted sand, and the design is made upon them with lithographic ink and pen. When the design is finished, it is prepared as if for the lithographic press. For this purpose, the plate is plunged into a decoction of nut galls for a minute. It is washed in pure water and gummed with a weak solution of gum arabic. The plate is moistened with a sponge, the design touched with essence of turpentine, and a lithographic cylinder coated with a varnish, rolled over the surface. This varnish covers exactly all the lines made by the designer. The varnish should have the following qualities: 1st, of not altering the design. 2d, of adhering strongly to the plate. 3d, of not being attacked by the chemical agents used to engrave it. The varnish known in England as *Brunswick Black*, mixed with oil of lavender, is preferable to all others. It is composed of asphalte varnish, linseed oil boiled with litharge and turpentine. When the varnish is dry, the zinc plate is put in connexion with a plate of copper, at a distance of $\frac{1}{5}$ of an inch, and plunged into a solution of sulphate of zinc marking 15°, thus a voltaic couple is formed, and the sulphuric acid dissolves all the uncovered parts of the zinc. More or less depth is given to the engraving according to the nature of the design. Pencil drawings are generally engraved in four or five minutes, pen drawings in from seven to ten minutes. The sulphate of copper produces no alteration in the most delicate lines, and does not attack the varnish.

This mode of engraving may be applied to any other process by which a design is reproduced. The drawing may be made upon paper and transferred upon the plates. Impressions from lithographic stones, from copper, or steel, may be transferred. Graving tools may also be used, and as well upon the zinc as upon lithographic stones, for the purpose of producing a flat shade. This process is equally applicable to printing type. It is sufficient to have a page of a book transposed upon a plate of zinc to make a stereotype.

This mode of engraving will replace the ordinary stereotype. According to this method, a page of a book may be transposed, during the printing, upon thin sheets of zinc, and from these upon stouter sheets, for engraving whenever a reprint is desired. Hence arises a great economy in composition and paper, since it is not necessary to print large editions. A copy on thin sheets of zinc will not cost more than a copy on good paper.

In the same way a stereotype may be made of old books.—*Comptes Rendus de l'Academie des Sciences de Paris*, November, 1855.

On a New Coating for Walls. By M. Claudot.

The author proposes to paint the walls with the milk of lime, which by absorption of caloric acid from the air will form a permanent coating, and prevent the formation of lichens which stain and destroy the surfaces. He also suggests the same application as a species of enamel on mantels, clock-stands, and earthenware. (*Comptes Rendus de l'Academie des Sciences de Paris*, November, 1855.)

The process, is not new; it was suggested in this country many years ago; we believe, by Professor Emmet, of Baltimore. We have seen many

medals and statues in plaster of paris beautified and preserved by immersion in a solution of carbonate of soda, by which their surface is converted into crystalline carbonate of lime. Care should be taken that the solution contains no bi-carbonate or excess of carbonic acid, otherwise the coating will be dissolved. ED.

TWENTY-FIFTH MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.*

On the Meteorology of the United States and Canada. By Mr. R. RUSSELL.—He first drew attention to the physical geography of North America, as influencing in a very particular manner the meteorological phenomena of that country. The Appalachian chain, from Northern Alabama to Maine, runs parallel with the Atlantic coast, and though only from 2000 to 4000 feet in elevation, exercised a marked influence in giving peculiar development to certain atmospheric disturbances which took place in the Atlantic States. To the west of this chain lies the vast valley of the Mississippi; its surface forms an easy ascent towards the Lakes of about one foot in a mile. This great basin is thus exposed to the free course of the south winds from the Gulf of Mexico. But the Rocky Mountains on the west, stretching from the Arctic Circle, appear to be the grand physical feature which in a great measure determines the peculiarities of the meteorology of North America. This range has an average elevation of 10,000 to 12,000 feet, which is almost unbroken to the Isthmus of Panama. This vast natural wall forms a barrier to the trade-winds of the Carribbean Sea, as they cannot cross this ridge and flow into the Pacific. By means of this elevated land, which forms the isthmus connecting the two continents, the trade-wind is gradually directed northwards until it reaches Texas as a south wind, which is the prevailing one in that State throughout the year, but more especially in summer. The great fertility of the climate of the United States and Canada, is to be chiefly ascribed to this physical feature of the country. The flow of the south wind in winter brings moisture and mild weather—in summer intense heat, with thunder storms. The wind which is entirely opposite in its character to the south is the west. In winter, a due west wind is intensely cold over the whole territory of Canada and the United States, and it often blows with great violence: there is no relaxing of the cold weather so long as it continues. In summer it is dry, and the sky assumes that bright azure tint which is so striking to one from our island. It is a singular fact, that a west upper current flowing across the Rocky Mountains seems to prevail almost constantly during the whole year. This must never be lost sight of in discussing the atmospheric phenomena of North America. The upper current is nearly due west at Washington and the States to the south; it is a point or two north of west in the New England States and Canada. The west and north-west wind of the United States must be regarded as the descent of the upper current. In fact, the winds of the United States, especially during great atmospheric

*From the Lond. Athenæum, September, 1855.

disturbances, may all be considered to become modifications of the south and the west wind. The indications of the thermometer and hygrometer are entirely in favor of this arrangement. The N. and N. W. winds must be regarded as modifications of the upper westerly current descending to the surface of the ground, and the S.W., S.E., E., and even N.E., as modifications of the south wind. The difference betwixt the temperature of the Arctic current and the Gulf stream, as they meet beyond the Newfoundland coast, is not nearly so great as the difference of the temperature, in winter, between the west current which descends along the eastern slopes of the Rocky Mountains, and the south wind from the warm waters of the Gulf of Mexico. The vast territories of the United States to the east of the Rocky Mountains, are subjected alternately to these two currents, so opposite in their characters, and hence the great changeableness of the climate, to which we have nothing that can be compared in Europe. The exceeding coldness of the west wind arises from its being robbed of its moisture as it crosses the Rocky Mountains. It is specially worthy of being kept in mind, that the west wind, or its modifications, is light and pleasant in the warm season, but intensely cold in winter, and blows with great vehemence when it succeeds the south wind. After the west wind has blown for some time in winter, the whole area over which it has extended is subjected to a great depression of temperature. As a general rule, the temperature rises in the far west in winter for some time before it rises in the Atlantic States. The weather first moderates in the territory east of the Rocky Mountains and west of the Mississippi, by a south wind, 500 to 700 miles in breadth, setting in and blowing along the eastern slopes of the Rocky Mountains, and probably extending into the Arctic Circle. The rise of temperature thus takes place over all the region swept by the south wind. The rising of temperature is apparently propagated from west to east in the United States, by the south wind flowing in succession over those States which are more westerly. This is the cause of the winter storms of the United States traveling from west to east, as has been maintained by Prof. Espy, who was the first that made the discovery, and which has since been corroborated by Profs. Hare and Loomis. The distance between the ridge of the Rocky Mountains, and the east coast of Florida, is about 1400 miles, but in the latitude of Newfoundland, the Rocky Mountains are nearly double that distance from the Atlantic. The south wind never seems to occupy at one time the whole breadth of the country from western Texas to eastern Florida. The south wind is rapidly propagated from the west along the northern shores of the Gulf of Mexico, but it is almost as rapidly destroyed on its western edges by the cold upper current descending along the eastern slopes of the Rocky Mountains, and penetrating, as a surface wind, this warm current from the Carribbean Sea. In this manner the western edges of the south wind are raised into the upper current, and drifted towards the east. Thus the winter storms of the United States are always succeeded by a cold wind from a westerly direction. The cause of the violence of the west wind in winter was then shown. The weather during summer was regulated by the same principles, but the north-west wind then lost its power, in consequence of its being warm and elastic. The thunder-storms and

tornadoes generally drifted from west to east in the Middle States, and from north-west in the Northern States. This arose from the clouds being formed in the upper current and drifted towards the east at the very time that the south wind was prevailing. The thunder and tornado clouds usually drifted in the south wind over the States bordering on the Gulf of Mexico. The hurricane-clouds also drifted in the southern stream of warm air, and were often propagated along the Atlantic coast. The fluctuations of the barometer were attributed to the fluctuations of density of the air at the surface of the earth. This was Dalteri's hypothesis, which he thought explained the fluctuations of the barometer more consistently than any which had been offered. It did not explain all in Britain, but it explained a great deal,—the apparent exceptions were all grouped together very consistently. The height of the barometer was inversely as the temperature, or rather moisture, for the latter was a more permanent cause of high temperature. Diagrams were exhibited to illustrate this connexion between the rise or fall of temperature and the fall or rise of mercury. By adopting the arbitrary scale of 5° of heat as equal to 1-10th inch of mercury, which indicated the south wind to be about 10,000 feet in height, a great parallelism between the curve of temperature and inverted curve of the barometer was exhibited. A more perfect explanation of the fluctuations of the barometer at Alabama could not be given. The south wind being lighter, depressed the barometer at every place when the temperature was raised. The low barometer extended in a long line from the Gulf of Mexico to the Lakes, and traveled to the east as the rains and high temperature did. The grand exceptions to fluctuations of the barometer being occasioned by fluctuations in the density of the air at the surface of the earth, arose in the West Indian hurricane, when a depression of two inches was sometimes observed to take place. The only theory which successfully met this phenomena was that by Prof. Espy, in which the wind blowing towards a central space rose in consequence of the extrication of latent caloric, by the condensation of moisture through the expansion of the air causing a reduction of temperature below the dew point. Prof. Espy maintains that the whole force generated during hurricanes can be accounted for by the effects of heat,—Prof. Hare, that part is due to electrical agency. In the case of the sea-breeze, a considerable body of air is put and kept in motion by slight differences in the weights of adjoining columns of air. Were such differences of the atmospheric conditions as the chart of the 10th of November exhibited, between the mouth of the Mississippi and Montreal, tremendous disturbances would ensue. When the distance is great the power is diffused in moving the whole body of air betwixt the stations. The expenditure of power in this diffused manner may be compared to the flow of the Mississippi over the last 1400 miles of its course, where the fall is less than three inches to a mile. On the other hand, when the Niagara tumbles over its great precipice, it expends much power at once. The hurricane might be regarded as an aerial cataract, only the air being forced upwards. If a slight fall of rain produced such remarkable effects as are noticed on the passage of the squall-cloud, what must be the power evoked by the evolution of latent caloric in hurricanes! Six inches of

rain have been known to fall during some hurricanes. The caloric set free by the condensation of this amount of water over every square mile is equal to that which would be generated in the burning of 2,620,000 tons of coal, allowing 1 lb. of coal to evaporate 13 lbs. of water. The clouds of the hurricane interrupt the ominous calm as suddenly as the smooth flow of the stream is changed at the brink of the cascade. Prof. Espy has made this neglected department of meteorology the subject of most profound investigation. At the last meeting of the British Association in Glasgow, Prof. Espy attended and expounded his celebrated theory of tropical hurricanes. He would again have appeared before you at this visit, had not the fatigues of a voyage across the Atlantic in the evening of life deterred him from doing so. Mr. Russell said he had conveyed a request from him to Sir D. Brewster, to move for a committee of the British Association to inquire into the disturbing forces of the tropical hurricanes. Mr. Russell concluded by saying that he hoped it would be granted, as the present state of the science imperatively demanded it.

Notices of Rain-Falls for a Series of Years at Home and in Foreign Countries. By Mr. SYMMONDS.—After pointing out the advantages which would result from an accumulation of facts that would serve to guide us to a knowledge of the mean average fall of rain in certain periods—the proportionate evaporation, and the alternation of wet and dry seasons, Mr. Symmonds pointed out the value of such inquiries to the agriculturist, the physician, and the statist; and showed how important was this knowledge of the mean annual fall of rain in particular localities, and the average number of days in which rain fell in the year. Particular crops, as the sugar-cane, the indigo plant, the cotton and tobacco plants, might be entirely ruined by too much or too little rain. Many localities, such as Malta, Gibraltar, Ascension, &c., are obliged to husband the rain-water in tanks. The navigation of rivers and the irrigation of adjacent lands are also dependent on a certain amount of rain. And the potato, the vine, and other plants are injuriously affected by the condition of the atmosphere and the superabundance of moisture. Even the fact of whether the moon has any influence on the fall of rain is still a disputed point. The relative proportions of rain that fall by night and by day was another point touched on. Mr. Symmonds then took a survey of the records of this branch of meteorology in the various quarters of the globe, citing the comparative falls of rain in the tropics and in temperate regions in various countries. The enumerations were perhaps the most full and complete that have ever been collected on this important subject.

Extracts from a Letter from the Rev. A. Farrar, of Queen's College, Oxford, on the late Eruption of Vesuvius—Were read by Dr. DAUBENY. —The writer stated that for a period of three years from 1847, the volcano exhibited symptoms of restlessness, &c., and on one occasion, December, 1849, sent out a small stream of lava, interesting from the fact of crystals occurring in it, analogous to those of the little stream of 1845. But in February, 1850, a violent eruption took place, from three craters, which formed on the south-east of the great cone, each above the other, in a vertical line from the summit to the foot. In fact, owing to the

abundance of lava, it might be almost said that a great fissure opened from the summit nearly to the Atno del Cavallo. The stream flowed along the Atno at a point a little to the north of the stream of 1834, and then turning south; when, pressed back by the ancient lava of Monte Somma, it flowed over the current of 1839 in the direction of Ottagaus and Bosco Reale, destroying much of the fine oak of the forest; the stream continuing to flow for three days. Such was the history until the present eruption, which might be said to have commenced last December by the sudden giving way of a portion of the cone of Vesuvius, at a distance of perhaps 100 yards north of the northern of the two craters formed by the eruption of 1850, and a very little distance below the level of the summit. This crater or hole, for it had never vomited anything but gas, still existed, though now piled up by débris to within a depth of 100 feet. Mr. Farrar felt a peculiar interest in this hole, from the hope—though one perhaps could hardly hope it at that height—that it would reveal the internal structure of the west cone, so as to throw light on the question of craters of elevation.

On Alloys of Iron and Aluminium. By Prof. CALVERT.—Messrs. Calvert and Johnson, of Manchester, have succeeded in preparing the following alloys of iron and potassium:—1st alloy: 4 equivalents of iron, 1 ditto of potassium. 2d alloy: 6 equivalents of iron, 1 ditto of potassium. These alloys were prepared with the view of solving one of the great chemical and commercial questions of the day—namely, that of rendering iron less oxidable when exposed to a damp atmosphere; as these gentlemen believe that no kind of coating can be discovered which will resist the constant friction of water, as is the case with iron steamers. They have also succeeded in producing two new alloys, composed of iron, combined with that most valuable and extraordinary metal, aluminium, lately obtained by M. St. Claire Deville. These two alloys are composed as follows:—1st, 1 equivalent of aluminium; 5 ditto of iron. 2d, 2 equivalents of aluminium; 3 ditto of iron. The last alloy presents the useful property of not oxidizing when exposed to a damp atmosphere, although it contains 75 per cent. of iron.

On the Titaniferous Iron of the Mersey Shore. By Dr. EDWARDS.—Dr. Edwards remarked upon a form of titaniferous iron which occurs on the western shore of the Mersey, and gave his analysis of it, by which it appears to contain 13·20 per cent. of titanic acid, which is its most valuable constituent. It disintegrates from boulders found in the clay drift along the shore of Seacombe, and becomes mixed with the sand, from which it is separated by means of a magnet. It also contains alumina, silica, and magnetic oxide of iron; hence it possesses magnetic properties. The mineral does not belong to the series of rocks of the neighborhood of Liverpool, but exists in large masses, and has been carried by drift from the hills of Cumberland.

On the Action of Sulphurets on Metallic Silicates at high Temperatures. By D. FORBES.—This communication first treated of the sulphurets of metals formed by fusion, showing that very distinct compounds were thus formed generally more basic than under other circumstances. The action of sulphurets on silicates was illustrated by a series of researches, which showed that when the silicate of a weaker metal was fused along

with the sulphuret of a stronger one, or *vice versa*, the result was the same,—not a perfect mutual decomposition, as would have been expected, but the production of a double sulphur-salt of both metals. When the fusion, however, took place at lower temperatures no action was found to take place. A series of specimens illustrated the occurrence of such re-actions, metallurgical operations and their chemical composition, &c.

On a Process for obtaining and purifying Glycerine, and on some of its Applications. By Mr. G. F. Wilson.—The manner in which it is prepared is by placing a piece of common fat in a quantity of super-saturated steam ; the fat is decomposed, and resolves itself into two substances, viz., as acid and glycerine. The latter having a taste like sugar—is applicable to the cure of burns, rheumatism, and ear diseases ; it is a substitute for cod-liver oil, and also for spirits of wine ; also for the preservation of flesh ; and can be applied to photography, and preserving animals in their natural colors.

On the Composition of Bread. By Dr. Maclagan.—He gave the results of some experiments which he himself had made. The amount of moisture in bread was less, and consequently the nutritive value greater, than was generally allowed. The late Prof. Johnston had stated that a sack of flour produced one hundred quartern loaves. But, according to his (Dr. Maclagan's) examination, the sack of 380 lbs. gave 94¼ loaves of bread ; 100 lbs. of flour giving 231 lbs. of bread. The majority of bakers were of opinion that the sack produced, on an average, 92 loaves, and there was no great discrepancy between this and the result of his own analysis. Unfermented bread contains, of dry flour, 60 ; moisture, 10 ; water added by baker, 30. 100 lbs. of flour will give 143 lbs. of bread, and a sack of flour will yield 100½ quartern loaves of unfermented bread.

Baron Liebig made a few observations on a new mode of making bread introduced into Germany. Lime-water had been used in the preparation of the dough, and the loaf was rendered still more nutritive than that made by the common mode.—Dr. Playfair said the Section were much indebted to Dr. Maclagan for his communication. Much discrepancy existed among analytic chemists on the subject ; but he believed Dr. Maclagan had arrived at pretty accurate conclusions.

For the Journal of the Franklin Institute.

Iron Ships.

The advantages attending the use of iron as a material for ship building are so many, that it is a matter of surprise, that up to the present time in this country, they have been almost entirely overlooked. We have on the Delaware a few steamboats where its merits have been appreciated, and the saving by reducing draft of water in consequence of less weight of hull, is of itself more than sufficient to counterbalance any increased first cost of construction. In addition to this, iron is more lasting. After ten years in a wooden ship, and half that time in a sea steamer, the frames, planking, etc., become so decayed, as to be a constant source of expense, and I am informed that our insurance offices consider eleven years as the *average* duration of timber built ships. We have but two iron vessels, that I am aware of, constructed for sea service—the coast

survey steamer, *Walker*, and the revenue cutter, *Polk*. These vessels have been in use for eight years, and a recent examination of the former vessel, when on the dock, did not exhibit any symptoms of decay beyond a very slight rust; the bottom plates appear as thick as when first put on, and, in fact, all that portion of the hull made of iron was in good condition, while the wooden decks and water-ways were very nearly worn out. In England the merits of iron are more fully understood, and a wooden vessel there is as rare as an iron one here. Many of the iron ship builders are those formerly engaged in timber built vessels, and in a few years the merchant ships of England will nearly all be of iron. It may be urged that iron is more costly and timber much cheaper here than there. This is true, but yet is not sufficient for the neglect on our part to examine into the matter more fully. Within the last five years the wages of ship carpenters (always in advance of those in England) have advanced. Ship timber of all kinds is worth more than then, and the price of good timber will be constantly advancing from its increasing scarcity, which has caused for years past the use of inferior material. Copper, which enters largely into the construction of timber built ships, has in that time advanced twelve cents a pound, or about 50 per cent. While this has been the case with the material used in timber built vessels, iron has, on the contrary, not advanced, and can, at the present time, be purchased at a price sufficiently low to enable vessels to be built at a price but little, if any, exceeding the cost of a *first class* timber built vessel. But admit that the iron vessel should cost ten or even twenty per cent. more than the wooden one, look at the advantages to be gained, viz:—

Increased capacity as to bulk of freight equal to 20 per cent., which, on a ship, carrying 5000 bales of cotton, would make a difference of 1000 bales, increasing freight money in the same proportion.

Safety at sea from not leaking, and when injured by collision, not sinking, the iron bulkheads preventing this, as in the *Vesta*, the ship that came in contact with the *Arctic*.

Durability.—An iron vessel will outlive three wooden ones. Twelve years make no impression on them—witness the account of the iron ship, *Richard Cobden*, that has been employed in the East India trade.

The following is taken from the *Liverpool Albion*, October, 1855—

"The iron ship, *Richard Cobden*, which was built at Liverpool twelve years ago, will repay a visit from any one interested in iron ships. She has been twelve years in the East India trade, and has not had the slightest repairs done to her; has never made a drop of water, and will, to all appearance, last to an unlimited length of time. This vessel has completely set aside the old notice of A 1, for twelve years."

A timber built ship has a very great number of vertical and horizontal joints between the planks where there is no connexion, which are filled with oakum to prevent the vessel from leaking, and it is the starting of one of these at sea that causes many a ship to founder, and damages cargo to the amount of many hundred thousands of dollars annually; this is an evil inherent in wooden vessels, and nine out of ten suffer in some degree from it every voyage. An iron vessel, on the contrary, has not such a seam in her construction; every sheet is made to lap its neighbor, and they are firmly riveted together, making the vessel as one piece.

The introduction of iron ship building among us, would do much towards increasing the consumption of plate iron, one of the staple productions of our State, and, at the same time, it would give to the merchant a better and more *profitable* vessel. It is necessary, however, for some one to commence, and I hope that there is sufficient enterprise and money among us to do it. If the plate iron dealers themselves were to undertake it, they would be doing what would very soon give them a large increase of business, and, at the same time, making an investment that would be sure to yield them a liberal return. X. Y. Z.

NOTE. The only iron vessel at present building in this city, is a small steamer by Messrs. Merrick & Sons, at the foot of Reed Street, intended for Lake service.

For the Journal of the Franklin Institute.

Iron Ship Building.

Few persons are aware of the extent to which this business is carried on in England, and the following details of the two largest steamers at present afloat, which have been recently built, will no doubt be of interest to your readers.

First. The *Royal Charter*, built for the Australian trade; her length over all is 336 feet, breadth of beam 42 feet, depth of hold 26 feet 6 ins., registered burthen 2700 tons; independent of her steam power, she is a full rigged ship and spreads 15,000 yards of canvass. Her auxiliary steam power consists of two engines, with cylinders of 45 inches diameter, 2 feet 3 inches stroke. Propeller 14 feet diameter, 13 feet pitch; the propeller shaft is 130 feet long; the coal bunks will contain 425 tons, which is more than will be required for the time she will have to steam on her passage out. When under canvass, the screw is disconnected and hoisted out of the water, which requires but ten minutes. On her trial trip with a pressure of 13¾ lbs. of steam, the engines making 75 revolutions, she made an average speed of nine knots in smooth water.

Second. The *Persia*, built for the Cunard Line, and expected to exceed in speed any steamer at present afloat on the ocean. Her dimensions were given in the last number of the *Journal*, (page 66,) but the following details of her construction will show in what manner she is put together. The framing of the ship is very heavy. The space between each frame is only ten inches, and the powerful frames or ribs are themselves ten inches deep, with double angle irons (knees) at the outer and inner edges. The bow is constructed in a manner at once peculiar, and affording the greatest possible strength to this important part of the ship. The framing is so placed to the stern that the effect is that, in the case of collision with other ships, or with rocks, or icebergs, the strain would fall upon the strongest material within the structure, and the *Persia* would have a good chance of safety and successful resistance, while ordinary vessels would indeed be in great peril. She is not clinker-built, as some ships have been constructed of late. The plates, or outer planking of the ship, so to speak, are laid alternately, so that one adds strength to the other, and they form a whole of wonderful compactness and solidity. The keel-plates are $\frac{1}{16}$ths of an inch in thickness; at the bottom of the ship the

plates are $\frac{1}{16}$ths of an inch in thickness: from this section to the load water-line they are $\frac{3}{4}$ of an inch; and above this they are $\frac{1}{16}$ of an inch in thickness. The plates round the gunwale are $\frac{7}{8}$ of an inch in thickness. She has two engines, and eight tubular boilers, and two funnels; and we need only speak of her machinery in general, which is all ready, as being first-class. The firing space for the boilers is placed in the fore and aft line, instead of across the ship, as is usually the case with smaller vessels.

The weight of the iron in the *Persia*, when launched, was 2200 tons. When the engines are on board, and fully loaded, the weight of the immense mass will be 5400 tons, at which time she will draw 23 feet of water. Her coal cellars are constructed to receive 1400 tons of coal—an ample supply to carry her on her voyage across the Atlantic as fast as she can burn them. She has also accommodation for about 1200 tons measurement of goods.

On her trial trip from Govan to Liverpool, a distance of 175 knots or 203 miles, which she run in 10 hrs. 43 min., equal to 16 knots or 19 miles per hour, which was great speed, even if we allow that she was light, as was probably the case; she will no doubt be very fast, and test the Collins line, including the *Adriatic*, to their utmost. B.

On Measuring the Length of Connecting Rods of Steam Engines.

To the Editor of the Journal of the Franklin Institute.

Sir:—If you do not consider the following query an intrusion, an answer would oblige more than one of your *younger* readers in this vicinity.

In a direct action engine, why is the length of connecting rod taken as the distance from centre of cross-head pin to centre of *crank-shaft*, instead of *crank-pin*, when the crank is vertical, or, in beam engines, from main centre to the plane of crank-shaft centre, instead of from centre of pin in the beam, to centre of crank-pin?

Yours, respectfully,

Lowell, January 8, 1856. T. W. S.

Reply.—In a direct acting engine, the length of the connecting rod is equal to the distance between the centre of the cross-head pin (when the piston is at half stroke) and the centre of the crank-shaft, for this reason:—As the throw of the centre line of the crank-pin, on each side of the shaft, is equal, it is evident, that the middle point of the crank-pin's complete throw or stroke, is coincident with the centre of the crank-shaft; and as, by supposition, the cross-head pin is in the middle point of its stroke, it follows that the distance between the centre of the cross-head pin and that of the crank-shaft is proper for the length of the connecting rod.

The distance from the centre of cross-head pin, at half stroke, to the centre of crank-pin, when the crank is at right angles to the centre line of the cylinder, would be too great, except in the supposititious case where the rod is of an infinite length. In all other cases, as the rod forms an angle less than 90°, with the line joining the centres of the crank-shaft and pin, when the crank is at right angles with the centre line of cylin-

der, there would be an excess of length equal to the difference between the base and hypothenuse of a right angled triangle, in which the base A B, is formed by the line joining the centres of the cross-head pin and crank-shaft; the perpendicular, B C, by the centre line of the crank; and the hypothenuse, A C, by the centre line of the connecting rod: then, by the well known formula,

$$A\,B^2 + B\,C^2 = A\,C^2,$$

the excess can be found.

To get the length of connecting rods for beam engines, the following directions will be found on page 225 of the *Treatise on the Steam Engine*, edited by John Bourne:—"The length of the connecting rod is the distance from the centre of the beam when level, or the plane of the main centre, to the plane of the paddle shaft." This, though not strictly accurate, is perhaps near enough when the length of the beam is great compared with its stroke, but, in American river boat engines, the beam is comparatively short, in some instances, being only one and three-quarter times the stroke; consequently, the versed sine of the arc described by the end pin, in moving from the plane of the beam centre to the end of its stroke, is considerable, and affects the length of rod. The reasoning employed in the case of direct acting engines, to determine the centre of the shaft as one point from which to measure, applies as well to beam engines. Then, the length of the rod is equal to the distance between the centres of the crank-shaft and the end pin; for, if the plane of the beam be taken as a measuring point, the rod would be too short, because the length of the beam is such, that a vertical line drawn through the centre of the shaft bisects the versed sine of the arc described by the end pin, and, therefore, the deficiency in length would be equal to the difference between the base and hypothenuse of a right angled triangle, in which a vertical line passing through the centre of the crank-shaft would be the base A B, half the versed sine of the arc described by the end pin would be the perpendicular B C, and a line joining the centres of crank-shaft and end pin the hypothenuse A C; from which, by the afore given formula, the length may be calculated.

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*Consumption of Smoke.**

The following is a digest of the information with regard to the operations of inventions for the consumption of smoke, which has been elicited by the inquiries of the General Board of Health among persons who have employed inventions for this purpose, and forwarded to Viscount Palmerston by the General Board.

General Board of Health, Whitehall, July 20, 1854.

In accordance with the request of Viscount Palmerston, conveyed in Mr. Fitzroy's letter of the 31st day of October, 1853, the Board have instituted very extensive inquiries among those acquainted with the means for the prevention of smoke, a great part of the evidence thus received being given in abstract in the Appendix to this Report.

From the evidence thus obtained, it appears that smoke has been entirely prevented, in many cases, in that large class of furnaces used for

* From the Lond. Civ. Eng. and Arch. Jour., July, 1855.

boiling, as for steam engines, brewers' and dryers' pans, &c., without any alteration of the furnace, where it had in the first instance been well constructed and carefully attended to, and that it is easy very considerably to diminish the smoke commonly emitted from such furnaces without any extraordinary care, by alterations neither expensive nor troublesome, if the furnace is not very badly constructed.

It also appears, from this evidence, that in many such cases smoke has been prevented by good stoking *alone*, and by slightly opening the furnace door after putting on coal, and that smoke from all furnaces may be much more greatly diminished. If to good stoking be added one of the many contrivances for admitting air above or beyond the fuel, smoke may be very generally prevented, except when the fire is first lighted, and for short intervals after adding fresh fuel.

It also appears that where particular circumstances have rendered the prevention of smoke from bituminous coal difficult, many manufacturers have found it advantageous to resort to the use of smokeless fuel that produces no more smoke than can readily be consumed.

It also appears that smoke from almost all fires, such as those for warming rooms and cooking, for bakers' ovens and pottery kilns, may be very considerably diminished and in many cases entirely prevented, for that has been accomplished in several instances of each of the different kinds of fire.

Besides the information thus derived from a large number of persons interested in inventions for the prevention of smoke, the Board have also received returns from fifty-six firms which have adopted various means for the diminution of smoke. These returns refer to a far larger number of furnaces than fifty-six, as most of the firms in question use several furnaces. From this table it will be seen that in almost all these cases very considerable success has attended the efforts to reduce smoke. The reply to the question, "Have you succeeded in diminishing smoke?" has in twenty-three cases been simply "yes;" in eighteen other cases the answer is to the same effect, *e. g.* "almost entirely," "not more smoke than a private house," "completely, except when the fire is first lighted." Others seem to have been less completely successful, and make such replies to the question as "partially," "considerably," "yes, to some extent," &c. Three only of those to whom queries were addressed seem to have entirely failed.

After such instances of success it is impossible to deny that smoke may be prevented. Numerous cases indeed of partial and some of complete failure have occurred, but these only show that proper means have not been used, or that the means employed have not been adapted to the particular cases.

It has been commonly asserted that the requisite heat cannot be maintained without producing smoke; this difficulty has been experienced by only eight of the fifty-six firms which have sent returns. Some state that the difficulty has been slight, others, that increased heat has been occasioned in equal time with less fuel, and this, indeed, appears to be the usual result.

The effect upon the consumption of fuel has not been accurately observed, but in a large majority of cases a considerable saving has been

effected. In twelve only of the fifty-six has there been no saving; in three consumption has increased; in nine it is stated not to have been ascertained; in thirty-five the saving is variously estimated from five to fifty per cent. The explanation of this great disparity appears to be, that means for the prevention of smoke have often been accompanied by changes in the boiler, which may have been the chief cause of the saving. In other cases smoke has been prevented by admitting air in excess, which has carried off part or all of the additional heat produced by more perfect consumption.

The degree in which the prevention of smoke has been effected is also various. Unexceptionable experiments show that in some instances it has been all but perfect, while in these cases there has been at the same time a great saving of fuel. Mr. Houldsworth, of Manchester, for example, with Williams's Argand furnace, has obtained a saving of from ten to twenty-five per cent. and sometimes even from twenty-five to thirty-five per cent. A saving of one-half of the fuel now used might be obtained by altering some of the worst furnaces and boilers into the best.

Messrs. Dirk & Co., who state that the furnace for which they were agents (namely, Williams's expired patent of 1839), has been successfully introduced in above 2000 cases. This is one of the many plans, and perhaps the best, for admitting air beyond the fuel. It has been highly recommended, apparently justly, both for its scientific and practical merits.

G. F. Wilson, of Price's Patent Candle Company, reports that their company succeeded in preventing smoke by using anthracite coal with a fan, but when the supply of that coal became irregular and costly, they resorted with complete success to various patented processes. They now use Jukes's, Hall's, and Hazeldine's furnaces, three patented methods for carrying the coal slowly from the front to the back of the furnace. At Liverpool the company has fourteen furnaces of thirty-five horse power each, and nineteen at Vauxhall and Battersea, all, it is stated, giving perfect results.

"You will not wonder after the above," adds Mr. Wilson, "that it seems odd to us to hear of the impossibility of consuming smoke, and to see people so regardless of their pockets, sending good fuel up their chimneys."

Mr. Wilson regards these three inventions as so nearly equal in utility, that he would be guided in his choice of either by their cost and durability. "Our smoke consumers" says he, "do as much work with small coal as the old furnaces did with large." The saving with the same fuel appears to be about twelve per cent.

At Messrs. Truman, Hanbury, & Buxton's, brewers, Jukes's furnace has been used for four years, with great economy and success. Twenty years ago, viz., May 24, 1834, a patent on a similar principle was granted to Captain Bodmer, an eminent engineer of Manchester.

Samuel Hall's patent has been successfully worked in many instances, among others, at Woolwich Dockyard. It is said to be expensive.

The use of smokeless fuel has been adopted by many persons as best adapted for their particular cases. Welsh coal, coke, and various patent fuels are used. These act, by producing very little smoke, and that little is more easily prevented than under ordinary circumstances, but unless

there is sufficient quantity of air above the fuel, there is great waste with these fuels, as well as with common coal.

At the present prices, anthracite is stated to be an expensive sort of fuel, and sometimes there has been a difficulty in procuring it at all. It is, however, expected, that the supply will in future be more regular, and the price lower, and many persons have found it to their interest to use this sort of fuel.

A striking instance of pretty general success is presented by the case of Manchester, a local act for which borough requires that "furnaces shall, in all cases where the same shall be practicable, be constructed so as to consume or burn the smoke."

Joseph Heron, Esq., the town-clerk, in his communication on this subject states, "that the practicability has been so often proved, and is now so easily demonstrated by reference to existing works, *that it is no longer disputed, but taken as admitted* before the justices." In proof of the great improvement effected by the operation of the law, Mr. Heron copies a table showing the duration of smoke from twenty chimneys, as observed before the act came into operation, as contrasted with their present state. From this table it will be seen, that at that time, fourteen of these chimneys emitted smoke during more than four and a half hours out of nine; that six only emitted smoke for a shorter period; that three smoked almost without any intermission, *i. e.*, more than eight hours out of nine; that five smoked more than seven hours, and eleven more than five, and that none smoked less than one hour and fifty minutes. Mr. Heron now reports that the present state of the mills named in the table may be described in one word as most satisfactory; dense smoke is hardly ever seen, and smoke of any description is very rarely and only for very short periods observable from any of their chimneys. If ever seen to an objectionable extent, it is the result of carelessness on the part of the stoker or fireman, and an intimation from the Town-hall at once secures the attention necessary to abate altogether the nuisance.

Many instances in proof might have been given; for example, Messrs. Cook & Co. (of the Oxford-road Mills) made many experiments for preventing smoke previously to the year 1845, and on being then summoned before the justices, declared they had done all in their power to improve the state of their chimneys, and despaired of being able to make less smoke; they promised, however, to persevere, and try if anything further could be done, and the result soon was and has been since, that a stranger now looking at their chimneys might, and probably would, suppose that the mill was not working. It is understood this satisfactory working of good apparatus, which before had failed, was obtained by making a small addition to the fireman's weekly wages when he succeeded in preventing smoke, and a large deduction when he failed.

Mr. Heron does "not intend to say that the smoke nuisance is entirely abated. Much has been done, and the practicability of doing more has been abundantly proved, but of course in many cases difficulties are encountered, arising either from the want of boiler room, or the want of money to make the necessary alterations, which it is difficult to surmount, and even where the alterations have been made, constant attention and watchfulness are required."

The Board regret to learn that with all the improvements effected, Manchester is still a very smoky place.

One main difficulty in effecting the object in question is the want of means to secure the attention and watchfulness required. It has been suggested, that it would be highly useful for this purpose to keep a number of constables on the constant watch. If a few men were stationed upon some of the highest buildings in London, for example, such as the Monument or the Victoria Tower, a very small number would be sufficient, to keep all the chimneys of London under constant observation, and the officers would be near enough to identify any cases of breach of the law. It is only by some such plan of constant watching that this grievous nuisance can be quickly abated.

Mr. Heron concludes by saying, "I feel that I may say, without fear of contradiction, that the result of our own experience has at least proved beyond dispute, that in few, if in any cases, can the impracticability of consuming smoke be with propriety urged in justification or excuse for the nuisance." From a man who has had such excellent opportunities for forming a correct opinion as the town-clerk of Manchester, such a statement is of the utmost importance. It is completely confirmed by the results of Mr. Houldsworth's extended experience. Mr. Houldsworth has proved by his own practice, that the duration of the nuisance of dense smoke from furnaces, of even the most simple and common construction, can be reduced from forty per cent. of the whole time, to five per cent., at little or no cost for the alteration of the furnaces, and with a positive saving of coals. He, therefore, represents that there need be little hesitation in bringing legislative pressure to bear sufficiently to lessen the evil in a great degree at once; while, if time be given for the gradual replacement of the old by new boilers, with double furnaces, and an union of the flues close behind the bridges, and provision for the admission of air at that point, the smoke nuisance may be almost entirely abated, and the manufacturing towns free from the reproach. Little, however, will be done without smoke inspectors to warn and teach, and to initiate legal proceedings where parties are refractory. From the communications received it appears, that nearly perfect success has been attained by various contrivances, and in many cases without any contrivance at all by good stoking alone, and in others by the use of smokeless fuel, but that good success has rarely been attained without increased care by the stoker. Such care it is unreasonable to expect without in some way or other making it his interest to succeed, and at the same time providing him with a furnace by which he can succeed without very much additional labor.

A useful memorandum on this subject by J. A. Yarrow, Esq., C. E., will be found in the Appendix, wherein he shows that, by a weekly payment of five shillings in addition to wages, coke was saved to the value of 2*l.* 16*s.* per week, the saving in the consumption repaying the increase in the wages eleven times over.

It appears that many contrivances for preventing smoke which are very successful at first, subsequently fall into disrepute. An explanation of many of these cases is afforded by the fact that, as already stated, good stoking is essential to success under any circumstances. This is

secured while the invention is new, and while the inventor perhaps pays the stoker to make it succeed, but it fails when no special care is taken.

The communications concur in further representing that besides good stoking it is essential to have sufficient boiler surface, so that the requisite heat can be obtained from extended flues instead of from a fire unduly urged. Bad stoking and insufficient boiler surface are by many of the witnesses stated to be the main causes of smoke. Both of these causes it is evidently in the power of the manufacturer to remove, and the want of them cannot be justly pleaded in excuse for a public nuisance. It is, however, satisfactory to know that good stoking and sufficient boiler room are so economical to the manufacturer, that the cost of procuring those advantages is very soon repaid by the mere saving in fuel.

The evidence further shows that though special contrivances are seldom essential, they are often perhaps generally useful ; that there are almost innumerable patented inventions for this purpose, and that many of these are expired, of which, therefore, manufacturers may avail themselves if they please, without the infringement of any right.

Among such expired patents which have enjoyed a high celebrity, may be particularly mentioned Parke's split bridge, patented in 1820, since copied in numerous forms; and Williams's Argand furnace, patented in 1839, instances of the almost perfect success of which are very numerous. This has been the type of numerous recent patents. It was with this that Mr. H. Houldsworth conducted his celebrated experiments detailed to the Commons Committee of 1841, by which he proved a saving by the prevention of smoke alone of 18 per cent. on the year's operations, and of 35 per cent. where particular care was taken. He states that a still greater saving might be attained had he had the command of more extended boiler surface. Mr. H. Dirk, the late proprietor of this patent, states that any intelligent bricklayer may set up the whole apparatus for 30*s.* to 60*s.* for a thirty-horse boiler. That above 2000 have been erected, and wherever they are out of use it must be from sheer neglect. It is admirable for steam-boats, in proof of which ample evidence is given. Another very successful contrivance is the duplex furnace, *i. e.*, two furnaces with one flue, each being fed alternately, so that one fire being always clear, burns the smoke of the other. If this be combined as in Mr. Fairbairn's furnace with a channel for the admission of air beyond the fuel, so that one furnace passes an excess of heated air, and the other an excess of smoky gas (which burn as they mix,) the prevention of smoke is said to be very complete and perfect as long as the stoker takes care to keep one fire always bright. If, however, as is often the case, he feeds them both together, the object is of course defeated. A furnace on this principle was patented by William Losh, as early as 1816, and another by Thomas Hill in 1839, both of which patents are expired. How the existing patents for the same arrangement of fires differ from these and from each other has not been distinctly stated.

This is the plan said by Mr. Heron to be most in favor in Manchester, where the success in preventing smoke has been very great. This construction of furnace is stated to have other important advantages besides that of permitting the smoke to be perfectly and economically prevented.

(To be Continued.)

*East Indian Iron.**

We are glad to be able to add to our former good reports of the manufacture of East Indian iron. There will very shortly be five furnaces at work at Beypore. The ores of Malabar have proved as tractable in the smelting process as those of Salem; and the produce has quite sustained the expectation of the Board, whether as regards the yield or the quality of the iron for forge or foundry purposes. In proof of this, during four weeks of the month of January last, 135 tons of pigs of an excellent quality were yielded at Beypore by 216 tons of ore and 209 tons of charcoal fuel. In other words, about 32 cwt. of ore, and 32 cwt. of fuel, costing not more than 5s. 3d. and 18s. 6d. per ton respectively, according to the "cost sheet" furnished, have been found sufficient to make a ton of pig iron, the expenditure on account of labor at the furnace being at the same time at the rate of 8s. 10d. per ton of pig. The Madras railway from Beypore is progressing with great rapidity; and the company has contracted for all the wrought and cast iron work of the Beypore station.

Artificial Stone. †

Chalk, either in the lump, or reduced to a paste, and steeped in a solution of silicate of potash, absorbs a considerable quantity of silica. It acquires a smooth appearance, close grain, and yellow color. The stone thus prepared takes a very fine polish, and hardens by degrees from the surface to the interior. This process may be advantageously employed for making mouldings, delicate sculptured ornaments, &c.

Ancient monuments of calcareous stone may be preserved by washing with silicate of potash. White limestones are silicated with double silicate of potash and manganese. When the stones are too dark, excellent results are obtained by suspending in the silicate a little sulphate of baryta, which penetrates into the porous stone along with the silica, and remains there in a state of combination. The joinings may be concealed by fragments of the stone ground up to powder, mixed with the silicate of potash, and applied as a paste.

On Working Steam Expansively in Marine Engines. By Mr. E. A. Allen, of London.‡ §

It is proposed in the present paper to consider the practical or commercial advantages of working steam expansively in the marine engine, as distinguished from the theoretical advantages, which latter are better understood and more generally admitted.

It has been established theoretically, that considerable economy is obtainable by working steam expansively. Thus—if steam be allowed to

* Lond Practical Mechanics' Journal, October, 1855.
† From the London Artizan, Sept., 1855.
‡ From the Lond. Mechanics' Mag., July, 1855.
§ The substance of a paper read at the last Meeting of the Institution of Mechanical Engineers, Birmingham.

occupy or expand into twice the space it originally occupied, the power developed would be as 1·7 to 1, and according to the following Table :—

Spaces occupied by Steam, . . .	1	2	3	4	5	6	7	8	9	10
Power developed, .	1	1·7	2·1	2·4	2·6	2·8	3·0	3·1	3·2	3·3

The same volume of steam being used in all cases, and allowed to occupy the increased spaces during expansion.

Notwithstanding that this has been long known, it has only been comparatively recently that practical benefit has been derived to any considerable extent from working steam expansively, and even at the present day the principle is but imperfectly recognised, or at least is very inadequately carried out in practice.

The attention of the Institution has been called on several occasions to the advantages of working steam expansively, both in engines employed in manufactories and in mining works and also in locomotives; and the papers of Mr. Fairbairn, Mr. Samuel, and Mr. Clark, have taken up the subject in reference to those particular cases.

The object of the present paper is confined to the advantages of working steam expansively in *marine engines*, and to endeavor to arrive at the causes which have hitherto prevented the principle from being as successfully carried out and as productive of economy as in the case of pumping or other stationary engines.

It would almost seem that the apparent necessity of making the engines of steam vessels occupy the least possible space, actually prevented, for a very long time, any attempt whatever being made to economize fuel; everything being overlooked or considered unimportant when compared to the supposed advantage of having the engine space as small as possible.

It was very natural that the first step in the economizing of fuel, by working steam expansively, should be taken in places where the spaces which the engines occupied could be almost indefinitely increased; and we find, consequently, that the system of working expansively made very great progress, and may almost be said to have been perfected in pumping and winding engines, before its value was at all recognised in other cases. Pumping engines had been worked on the expansive principle for some time, before any attempt was made to carry it out in engines employed in the manufacturing districts; this being chiefly owing to the cheapness of coal and the consequent disregard of economy, and also to the circumstance of a more uniform motion being required.

It will be seen that in the case of engines of manufactories, the ground space was but little more limited than in the case of pumping engines, and probably quite as little limited in respect to vertical height. The boiler-room in these cases was also almost unlimited, as also was the weight of the machinery, and it was not until the principle of expansion was considered with reference to marine engines and locomotives, that the objections to increased bulk and weight of the machinery became, or appeared to become, so important, as to prevent its being carried into practice.

One very important matter appears to have been overlooked in considering the weight of the marine engine, and that is, that it is not simply the weight of the machinery that has to be considered, but the joint weight of the machinery and fuel. It is true that in the case of the first steamboats the weight of the fuel carried did not form so important an item as at the present time; yet, as compared to that of the engine and boiler, it was, and always must be, considerable in every steam vessel. In river boats it may be taken roughly at about one-quarter the entire weight of engines, boilers, and water, equal to about 2½ days' consumption, this being the least proportion.

The following Table gives the weight of coals usually taken by steamers, according to the length of voyage, &c.:

TABLE I.

Proportion of Weight of Coals to Weight of Machinery.

Class.	Service.	Station or Employment.	Number of Days' Consumption.	Proportion of Weight of Coals to Weight of Machinery.
1	River, ...	Thames and Clyde,	2½	¼th.
2	Coasting and Continental, . .	General Steam Navigation Company, Colliers, &c., .	10	Equal.
3	Ocean, Short voyages,	America and Government, . .	15	1½ times.
4	Ocean, Long voyages	Australia, ...	40*	4 times.
5	Ocean, proposed voyage out and home, . . .	India, &c., ...	70	7 times.

It will thus be seen that, except in river steamers, any saving in the quantity of fuel must be of vital importance, and the more so in proportion to the length of voyage.

In the large steamer now constructing for the Eastern Steam Navigation Company, the quantity of coals taken is proposed to be seven times the gross weight of machinery, so that any small per centage of saving would really amount to a considerable quantity.

On one occasion the *Crœsus* took nearly 1400 tons of coals, being about in the proportion of 7 to 1 to weight of machinery. This quantity was intended to work her outward and part of homeward voyage.

It will be found that, as a general rule, marine engines are only using their steam expansively to a very small extent, the steam usually being cut off at 3·4ths of the stroke, thus economizing in the ratio of 1·3 to 1 only, or say practically equal to a saving of 20 per cent. on the coal consumed, if no expansion were allowed to take place.

This amount of expansion is given by the slide alone having sufficient lap on the steam side. It is now usual, however, to fit expansion valves to the Government engines, as well as to many in the merchant service, for the purpose of working expansively when short of coal, or when the

* Steamers taking coal equal to only four times the weight of machinery, are obliged to coal on the way out and home.

vessels are running with a fair wind; but these appliances are never designed for continual working. The "link motion" is also used in marine engines for occasional expansive working.

From a pamphlet recently published by Captain J. C. Hoseason, lately commanding the *Inflexible*, it appears that so far back as 1842, the attention of the Admiralty was called to the subject now in hand, viz: the economy of expanding steam. But at that time the principal difficulty in using steam expansively was doubtless the low pressure at which the boilers were worked, being only about 5 lbs. per square inch.

It appears, however, that in 1842 the pressure in the boilers of the *Inflexible* was raised from 6 to 8 lbs., by Captain Hoseason's desire, and the pressure in the *Terrible* was fixed at 10 lbs.

In 1849, the Indian Government obtained a paper on the expansive action of steam from Messrs. Maudslay, Sons, and Field; and from the extracts given in Captain Hoseason's pamphlet, it would appear that the case was fairly made out.

To prove the extent to which the *weight of the machinery* could be increased without increasing the *gross weight* carried, the following example is given:

"Suppose a vessel with 400 horse-power engines working up to their full power; the consumption would be 30 tons per day, and she would carry 750 tons of coal, which would be 25 days' consumption.

The 400 horse engines would weigh . .	300	tons.
Coal, .	750	"
Total weight, .	1050	"

"Suppose the same vessel with 600 horse engines, but only working up to 400 horse-power, the consumption would then be 22½ tons per day, and she would carry 600 tons of coal, which is 26½ days' consumption.

The 600 horse engines would weigh . .	450	tons.
Coal, .	600	"
Total weight, .	1050	"

"Thus, with the larger engines, the vessel will carry 1½ days' more coal than with the smaller engines, and would save during 25 days the value of 150 tons of coal."

These facts having been pointed out so forcibly six years ago, it appears strange that the principles upon which they were founded should not have been carried out more fully than they have been. Comparatively, however, nothing has been done, although with respect to the Australian vessels, the necessity of economizing has increased threefold, from the quantity of coal required to be carried being just about three times that taken by the Government vessels, viz., about 4 times the weight of machinery, instead of 1½ times. It will be seen that as the necessity for economy increases, so does the facility or means of producing it increase, from the great proportionate weight of coal upon which a reduction can be made, in order to compensate for any increase in the weight of machinery.

In such cases as the Australian vessels, where the weight of coals carried amounts to 4 times the weight of machinery, a saving of 25 per cent. of the coals would allow of the weight of the machinery being doubled, without the gross weight being increased.

Take, for example, engines of 400 horse-power, weighing 300 tons, and the coals carried 1200 tons, making a total of 1500 tons. If the coals by more economical working can be reduced to 900 tons, then the engines may be allowed to weigh 600 tons, and the gross weight to be carried will only be the same, the coal saved being equal to 300 tons. Extending Messrs. Maudslay's example, it will be seen by the following Table II, to what extent the weight of the machinery could be increased without adding to the gross weight, in the case of the coals carried being equal to 4 times the weight of machinery, the power worked up to being the same.

TABLE II.

Showing the increased weight of Machinery caused by increasing the nominal horse-power or size of the engines, and also the necessary reduction in the quantity of coals taken, so that the gross weight may remain the same.

Power W ked to.	Nominal Horse-power.	Weight of Machinery.	Weight of Coals.	Total weight carried.	Consumption per day.	Number of days' Consumption.
H. P.	H. P.	Tons.	Tons.	Tons.	Tons.	Days.
Full.	400	300	1200	1500	30	40
400	600	450	1050	1500	22½	45
400	800	600	900	1500	20	45
400	1000	750	750	1500	19	40
400	1200	900	600	1500	18	35

From this it seems that an increase in the weight of machinery to 2½ times, still admits of coals sufficient to work for as many days, and saves 450 tons of coal.

The object of the present paper is somewhat different from that aimed at in the pamphlet referred to, although nearly the same considerations are involved. It was then desired to show that both the power and weight of the engines could be increased without increasing the gross weights carried, the increased power being only occasionally used—this being a most important point for war steamers, and others, when working against the hurricanes in the Indian seas, &c. This advisable increase of power, however, involves a corresponding increase in the first cost of engines, though attended with counterbalancing advantages.

It is proposed now to show how the *engines alone may be increased* in size for expansive working, and consequently slightly increased in weight, not only without increasing the gross weight carried, but how it can be done so as very materially to *lessen the gross weights* carried, that is, in coal and machinery, leaving greater stowage for cargo.

It is presumed that the power placed in vessels is now sufficient (whether it is so or not does not affect the present question,) and therefore in the examples given no provision is made for the engine power being even temporarily increased, although this would probably, in many

cases, be a great desideratum. Neither are the boilers supposed to be increased, either in number or size; but, to avoid complicating the deductions, they are supposed to remain the same, especially since at present marine boilers are too much overworked to last any length of time, and an increase of boiler room relative to the power would be desirable.

Strictly considered, however, the weight of the boilers would be diminished in about the proportion of the diminution of coal consumed.

Taking the five classes of steamers given in the preceding Table I, which shows the weight of coals usually taken in the several cases, it will now be necessary to give the spaces occupied by them in proportion to that occupied by the engines, exclusive of the boilers and passages. The following Table III, shows the floor or horizontal space occupied by the coal-bunkers in the five classes of steamers.

The engines, boilers, and water are supposed at 13 cwt. per horse-power.

The space occupied by coals is taken at 45 cubic feet per ton.

The floor space occupied by engines alone is taken at $\frac{3}{4}$ square foot per horse-power.

TABLE III.

Proportion of space occupied by Coals to that occupied by Engines alone.

Class.	Station of Service.	Weight of Coals in terms of weight of Machinery.	Depth of Coals in each Class of Vessel, approximate.	Horizontal or floor space occupied by Coals, in proportion to Engines alone.
1	River, ...	½th.	9 feet.	Equal.
2	Coasting and Continental,	Equal.	12 feet.	3 times.
3	Ocean, Short Voyages, and Government, . . .	1½ times.	20 feet.	3 times.
4	Ocean Long Voyages, . .	4 times.	25 feet.	5 times.
5	Ocean Proposed Voyage out and Home, ...	7 times.	50 feet.	5 times.

It will be seen from the above Table, that in the case of Government vessels, where the weight of coals is usually equal to 1½ times the gross weight of machinery, the horizontal space occupied by the coal may be taken at 3 times the space taken up by the engines themselves (that is, exclusive of boilers and passages,) or about equal to the total machinery space, if the boilers and passages be included.

In the example quoted above from Messrs. Maudslay, where the coal weighed 2½ times the machinery, instead of 1½ times, which is the quantity more generally taken, the horizontal or floor *space* occupied would be 5 times that occupied by the engines alone, instead of 3 times as given above. So that supposing the passages left the same, the 400 horse-power engines could be replaced by engines of 600 horse-power, and the saving of space required for coal would balance the increased space occupied by the engines, consequently leaving the total weights carried the same, and the total space occupied by machinery and coal (taken together) the same, with the 600 horse-power engines, as with the 400 horse-power.

[The author here gives another Table for the purpose of showing the relative weights of the different parts of the machinery in steam vessels, taken from two tenders supplied to the Government for paddle-wheel engines of 260 horse-power, and screw engines of 450 horse-power; showing also the average of 18 estimates sent to Government by different engine-makers, giving the separate weights of the various parts of the machinery (as the engines, boilers, water, wheels or screws, &c.) and from it draws the conclusion that it will be sufficiently near for his present purpose to consider the relative weights of the different parts of marine engines to be as follows,] viz:

	Per nominal horse-power.
Engines,	5½ cwt.
Boilers and fitting,	3 "
Water,	2 "
Wheels or screw,	1 "
Spare gear,	¾ "
Coal-bunkers (containing about 15 cwt. per horse-power,)	¾ "
Total,	13 "

The practical applications which are made of these particulars in the calculations contained in this paper are, first, that the weight of marine machinery may be fairly assumed at 13 cwt. per nominal horse-power,; and secondly, that the weight of the engines and spare gear together may be taken at *one-half* of the gross weight of machinery. This consideration is of much importance, as it is the engines alone that are supposed to be increased in size and weight, to admit of greater expansion of the steam; the boilers and wheels or screw being supposed to remain the same, as has been before stated.

(To be continued.)

For the Journal of the Franklin Institute.

Mechanical Engineering as applied to Farm Implements. By H. Howson, Civ. Eng.

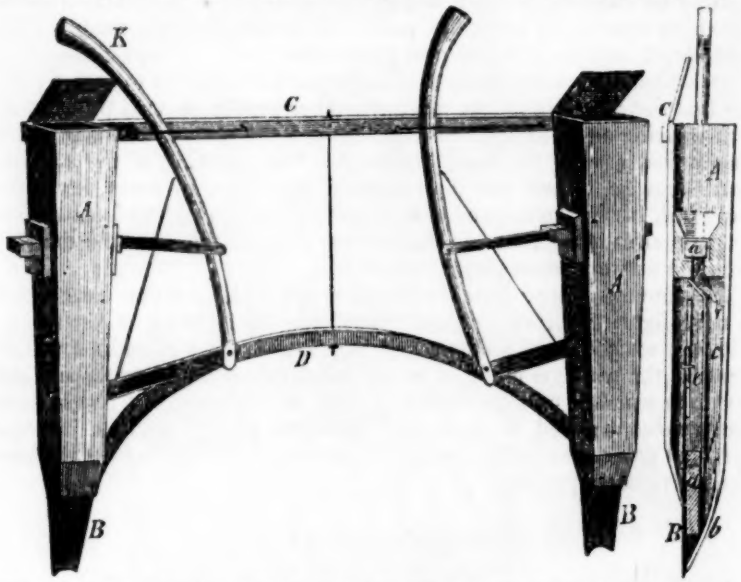
(Continued from page 45.)

Malone's Hand Corn Planter.

The writer's attention has been directed to another ingenious implement for planting corn by hand, an implement which possesses some of the characteristics peculiar to that of Mr. Wakefield's, illustrated and described in the last paper on this subject. Although not so simple perhaps, or so easily operated as the last named machine, the patented hand planter of Malone certainly possesses the important advantage of making two distinct deposits of seed in the soil at one operation.

In the annexed engraving of this implement, one view of which represents an external elevation, the other a vertical section; A, A, are two light tapering boxes of wood, the upper portion of which contains the seed to be planted. These boxes are placed a suitable distance apart, and are connected together at the top by light cross bar C, and towards the bottom by the arched piece D, and are furnished with iron shoes or planting points, B. Two bell crank levers, the long arms of which are

furnished with handles K, have their fulcrums on the arched piece D, the short arms passing through slotted openings in the lower portion of the boxes A, the ends of each arm being connected to a plunger *d* (see sectional view). This plunger is arranged to slide vertically in a compart-



ment *e*, which is separated from the external compartment *c*. The upper portion of each box which contains the seed, is separated from the lower which contains the above mentioned compartments, by a partition in which works the horizontal slide *a*, this has two openings, either one or both of which may be made to coincide with a vertical passage in the partition communicating with the compartment *c*, only. The slide *a*, of each box is connected by means of a jointed rod to one of the bell crank levers. A spring *b*, is secured to the lower end of each box, and presses with its point against the planting shoe B, when not otherwise disturbed by the operation of the plunger *d*.

In using this implement, the operator grasps the handles K, on the long arms of the bell crank levers, one in each hand. On raising the instrument from the ground after making one deposit of seed, the handles have a tendency on account of the peculiar position of the levers to be drawn towards each other; this movement raises the plunger *d*, and draws inwards the slide *a*, admitting as many grains of corn into the compartment *c*, as the openings in the slide *a*, are regulated to allow. As the spring *b*, is

released from contact with the plunger *d*, it closes against the shoe B, preventing the kernels of corn which now drop to the bottom of the planting point, from escaping before the next movement of the machine takes place. The operator now carries the implement to the distance required for making another deposit of seed, and then strikes it down with such force as to cause the points of the boxes to penetrate a sufficient depth into the soil; he now pushes the handles K, apart from each other, which causes the slides *a*, to be projected outwards to such a position that their openings may receive another supply of seed preparatory to their being again brought to coincide with the vertical opening which communicates with the compartment *c*. This pushing of the handles apart, likewise causes the short arms of the levers to press down the plunger *d*, in the compartment *e*, so as to open the spring *b*, and force the grain already deposited in the extreme point of the box, into the soil, when the first operation may be repeated.

The above is one of those farm implements which may be constructed of very light materials, without sacrificing the quality of durability. With the exception of the metal springs *b*, and shoes B, and a few light iron ties, the whole is made of wood sufficiently strong to withstand any shocks to which it may be submitted. The whole weight of one of these contrivances is stated to be no more than ten pounds, and the inventor says, that an active operator when accustomed to its use, can plant from four to five acres per day.

H. M. Johnson's Rotary Cultivator.

As a specimen of a class of farm implements, which during the last four or five years' use, have been partially used in several parts of the Union; is annexed, a perspective view and diagram of a rotary cultivator, invented and patented by H. M. Johnson, Esq., of Carlisle, Pa. This machine consists of a frame work, constructed with two end pieces, A and B, and two side plates, all secured firmly together.

In the side frames three shafts have their bearings, the first shaft being furnished with a series of circular rotary cutters *a a*, with sharp edges, their sides being slightly concave. The next shaft has another set of wheels *b*, precisely similar to the former, but having on their edges a series of knives *w w*, projecting laterally at such an angle as the wheels revolve and advance, that they descend edgewise, and ascend flat-wise, tearing up the earth from the bottom of the cut. The direction of these knives is indicated in the diagram, fig. 2, by the lines *o p*. The revolving cutters *b*, are so arranged as to pass alternately between the first wheels *a*, the width of the knives *w*, being just sufficient to clear the sides of the latter without coming in contact. The third shaft is furnished with revolving cutters similar to those on the second, the former passing between the latter as in the first instance. The action of this machine when drawn over the ground will be easily understood without further description. The patentee claims "a system of sharpened disks or rotary cutters, a part of which are armed, upon their periphery with knives projecting laterally, said knives being set obliquely to the radius of the

disk as described, the whole being combined and arranged in three se-

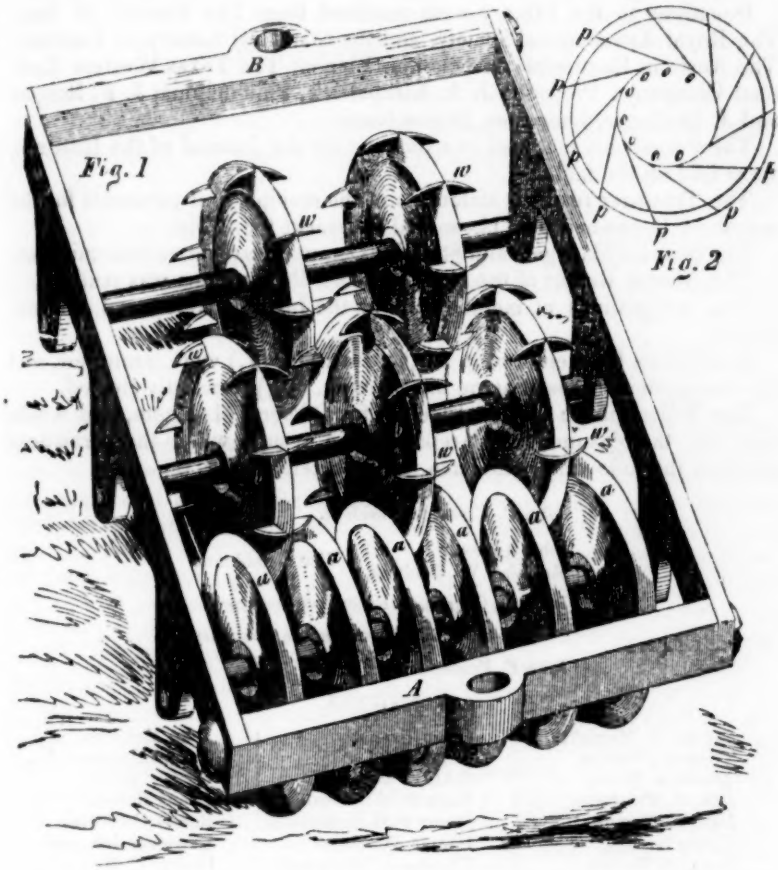


Fig. 1

Fig. 2

veral sets, so that the two sets armed with knives, shall cut alternately sections of the soil as set forth."

(To be Continued.)

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, January 17, 1856.

John C. Cresson, President, in the chair.
John Agnew, Vice President.
John F. Frazer, Treasurer.
John P. Parke, Recording Secretary, pro tem.
The minutes of the last meeting were read and approved.

A letter was read from Messrs. J. F. Reigart and J. Dellinger, of Lancaster, Pennsylvania.

Donations to the Library were received from The Society of Arts, The Royal Astronomical Society, and the Statistical Society, of London; The Austrian Engineers' Association, Vienna; The Texas Western Railroad Company; Professor J. A. Kirkpatrick, Philadelphia; J. F. Reigart and J. Dellinger, Lancaster, Pennsylvania.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of December, also his annual statement for 1855.

The Board of Managers and Standing Committees reported their minutes.

The Annual Report of the Committee on Publications was read.

Two resignations of membership in the Institute were read and accepted.

Candidates for membership in the Institute, (7,) were proposed, and the candidates proposed at the last meeting, (17,) were duly elected.

The Tellers of the Annual Election for Officers, Managers, and Auditors, for the ensuing year, reported the result, when the President declared the following gentlemen duly elected:—

John C. Cresson, President.

John Agnew, Matthias W. Baldwin, } Vice Presidents.

Isaac B. Garrigues, Recording Secretary.

Frederick Fraley, Corresponding Secretary.

John F. Frazer, Treasurer.

MANAGERS.

Samuel V. Merrick,	Owen Evans,	John McClure,
Thomas Fletcher,	Alan Wood,	Joseph Harrison, Jr.,
Abraham Miller,	John E. Addicks,	George Erety,
John C. Trautwine,	Isaac S. Williams,	Evans Rogers.
John H. Towne,	Henry P.M. Birkinbine,	Robert Cornelius,
Edwin Greble,	George W. Conarroe,	Lawrence Johnson,
David S. Brown,	Thomas J. Weygandt,	George C. Howard,
Thomas S. Stewart,	Joseph J. Barras,	Jacob Weaver.

AUDITORS.

Samuel Mason, Algernon S. Roberts,
James H. Cresson.

At a meeting of the Board of Managers, held January 23d, 1856, the following officers were elected for the ensuing year.

George W. Conarroe, Chairman.

Isaac S. Williams, Owen Evans, } Curators.

On motion of Dr. A. L. Kennedy, it was

Resolved, That the Committee on Exhibitions be requested to confer with Committees from other public Institutions, on the subject of the next Exhibition of the United States Agricultural Society in this City, and to

report at the March Meeting on the expediency of this Institute participating in said Exhibition.

BIBLIOGRAPHICAL NOTICES.

The United States Naval Astronomical Expedition to the Southern Hemisphere during the Years 1849–'52. By Lieut. J. M. Gilliss, Superintendent.

The United States Government certainly deserves credit for the liberality with which it contributes by every method in its power to the increase and improvement of science, and when we consider the limited nature of its powers, and the jealousy with which every step beyond their literal construction, is regarded by the always powerful opposition, it is really to be wondered at that it has ventured so much and with such success. Mr. Calhoun, himself, the strictest of constructionists, was, we believe, the first who ventured on this liberal policy, and his example has been frequently and creditably followed by his successors. Heretofore, much has been to be contended with, and especially the aversion to scientific duties manifested by the older officers both of the army and navy, who had not been educated to such tasks, and could not and did not wish to see the importance of them—saw at all events that they were derogatory to the character of a soldier or sailor. Oddly enough, this prejudice was deeper and longer continued in the navy, where they were compelled to practice some such observations in the fulfilment of their ordinary duties: for the school at West Point soon supplied our army with a body of highly educated young gentlemen, capable of appreciating the importance of their opportunities for increasing knowledge: and it is greatly to the credit of the navy that without such a means of education, and in face of the greatest difficulties arising from the manner in which the appointments are made, there has grown up within it so many scientific observers.

In the year 1848, the American Philosophical Society of Philadelphia, and the Academy of Arts and Sciences of Boston, addressed memorials to Congress, setting forth the importance to astronomical science, of certain observations of the inferior planets to be made at a point in South America, and in accordance with the views expressed and the consequent action of Congress, the Secretary of the Navy appointed Lieut. James M. Gilliss to obtain the requisite instruments and organize an observatory at Santiago, Chili. Lieut. Gilliss after successfully accomplishing his arduous undertaking and obtaining the data required, returned home and reported his astronomical observations, which have been already published by Congress. The present two volumes, are the result of his observations upon the country during his stay, and embrace a quantity of very interesting information in reference to its history, natural, social, and political. Of course during the short time that the book has been lying on our table, we have had no sufficient opportunity to study it closely, but a hasty glance at its contents, and a rapid perusal of those parts that appeared most interesting to us, have left no doubt of its high value as a contribution to our knowledge of this